PRICE 50 CENTS

American Machinist

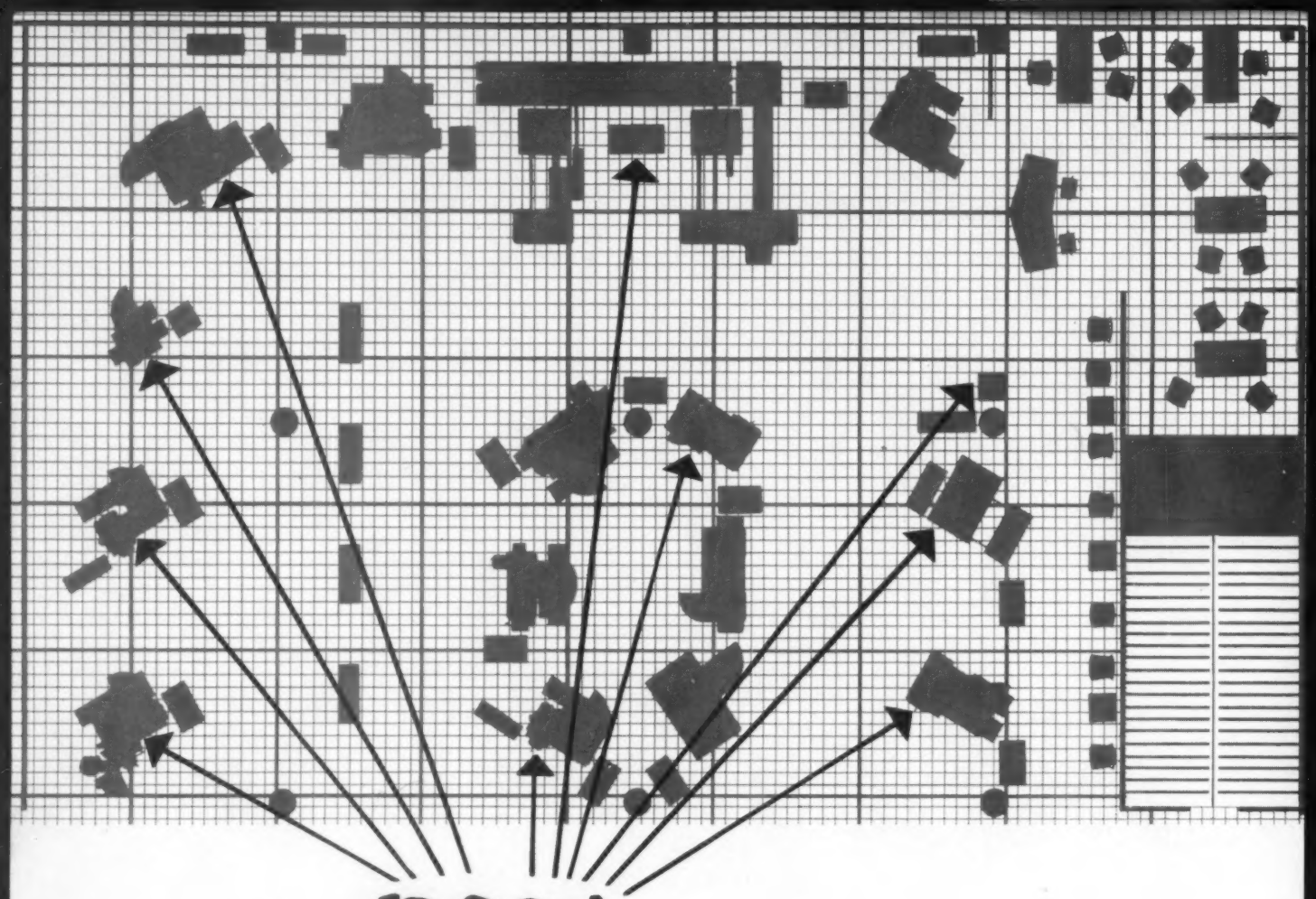
AUGUST 15, 1955

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

Milling [illegible]

How to Work Titanium . . . A SPECIAL REPORT

Trends in Furnaces



these new Heald developments are TOP SECRET now

THE SIXTEEN Heald machines shown in the above floor plan of Booth 902, represent the very latest advances in modern precision-finishing methods and equipment.

Some of these machines are completely new—never before shown to the industry. Others demonstrate outstanding new developments and improvements that will mean faster, better production of precision-finished parts. All machines will be in operation, on appropriate work.

Here you will see new machines with mechanical cycling—new automatic sizing methods—new self-adjusting grinding cycles—new wheel dressing procedures—new after-gaging and feedback systems—a fully automated multi-unit borizing setup—and a completely new angle in Bore-Matic design.

This is real progress in precision finishing—progress that means a new, higher return on "the world's best investment, in action".

...but you are invited to see them all, IN ACTION, in Booth 902 at the Machine Tool Show

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NUMBER OF COPIES PRINTED THIS ISSUE 37,741

chips

TOOL IN TUB . . . About 15 months ago (Apr 12 '54, p166), we published the first picture of an underwater machine tool. On our cover, and in a two-page article herewith, are more details. The cover picture is particularly unusual, because it was taken through some feet of water—in full color. Why the pit? To provide shielding, remove decay heat, and suppress contamination when machining nuclear fuel. And the water creates design problems on the miller. S L Lindbeck of Westinghouse (see biog) tells the story in two quick pages.

PLAN(T) FOR '56 . . . Plymouth, shooting at third place for '56, has built a startling new engine plant. We bring you the ideas—in 12 pages of pictures—and held up the presses to do it.

WORKING TI . . . When we published our first Special Report on the working of titanium (June 11 '51), there wasn't a great deal to say. Now there is much, so we come back at the subject, giving you in one compact 16-page package a summary of all the latest data we can find. Number of alloys has more than doubled; fabrication is now more "I know" than "I think—based on the little chunk we tested."

EATERIES . . . Eight years ago, we broke all precedents for a technical magazine by publishing a 4-page article on Where to Eat in Chicago, designed to help visitors to the Machine Tool Show. It was the hit of the Show, has been reprinted extensively since, in other magazines and as a booklet. Now Anson Meanor, the original gourmet, has prepared a new version, aimed at Mid-Chicago eateries. We've added a map of the central Chicago area and data on transportation, and put the whole into a tear-out 6-page insert that you can fold twice for carrying. Do a favor to your taste buds—or your ulcers—at Show time.

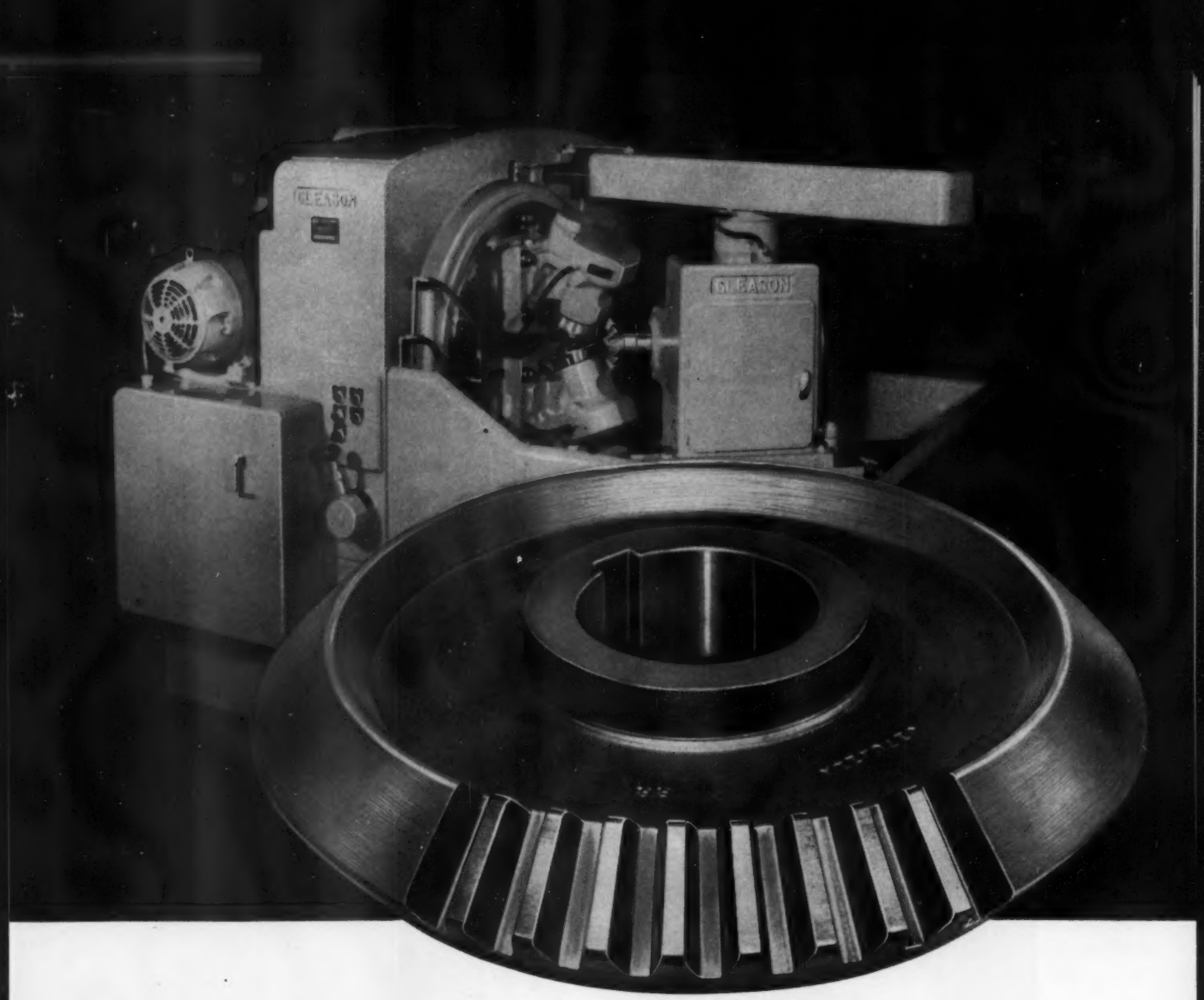
FURNACES . . . A H Koch of Surface Combustion did a paper recently on heat-treating furnaces. We've distilled from it what you'll want to know about modern design.

VALUES . . . Six years ago (July 14 '49), we published a memorable Special Report on Value Analysis at GE. To remind you of it, we add a spread of the latest items on which studies have been made.

TOOLING . . . Boeing's B-52 has been making headlines recently. From Wichita, we bring you pictures of the latest tools on the production line—for welding, planing, adhesive curing, presswork, and painting (a booth on rails) . . . Friden Calculating contributes a page showing how rubber male die and plaster female produce a glass-fiber calculator housing. It replaces aluminum, is lighter and stronger, cuts a 32-man-hr job to 4 hr.

COMING . . . Aug 29 *AM* is our Chicago Show issue. It will feature reports on new equipment at all three shows, lists of exhibitors, floor plans. There'll also be a 16-page report of a startling *AM* survey on buying plans and our regular news departments. Here's a big issue to watch for—and keep—as a preview and as a record of the Show.

WATER MILLER . . . S L Lindbeck was born in the San Franciso Bay area, but was strictly a rowboat man until 1945. He has his BSEE from Univ Calif-Berkeley and a Master's from Univ Pittsburgh in 1944, three years after he joined Westinghouse. For six years he engineered marine equipment —and went to Cuba in a cargo transport in 1945 to watch it work. In 1946, he switched to aircraft applications of the Rototrol, but in 1950 he went back to the Atomic Power Div and to work on the atomic-submarine power plant. Now he is in the large-ship reactor project. His story of the miller in a bathtub is in this issue.



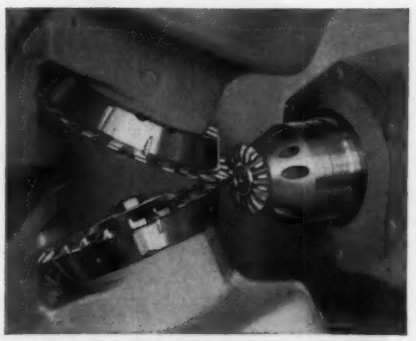
A complete gear for a fifth of a gear!

It all depends on the gear, of course. But, by the time an earlier model generator has cut one-fifth of a gear, the new No. 104 Straight Bevel Coniflex* Generator has *completed* a similar gear!

You can increase your production by as much as 400% with this new Gleason machine. You can get these results because this generator has two interlocking disc-type cutters with twenty-four blades each. These cutters complete a gear in *one rapid operation!*

But that is not all. The No. 104 is easy to set up—it has a wide range of capacity—it is excellent for small quantities or volume production. And, a new generating method insures high efficiency, fine finish, and maximum cutter life.

Write us and we will be pleased to send you a bulletin and further information on the new No. 104 Straight Bevel Coniflex Generator.



The No. 104 Straight Bevel Coniflex Generator completes gears up to 8½" diameter and 1⅜" face width, and from 20 to 3 DP.

*Coniflex® straight bevel gears with localized tooth bearing.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

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Accuracy

Guards have been removed to show a 13" diameter anti-friction bearing ring being ground on a CINCINNATI FILMATIC extended range Micro-Centric Grinding Machine.

within millionths

production ground on large parts

by EXTENDED RANGE MICRO-CENTRIC

CINCINNATI FILMATIC Micro-Centric Grinding Machine, built to accommodate extra large parts up to 14" diameter. Brief data will be found in Sweet's Machine Tool File.

Splitting the inch to master gage tolerances has become commonplace for many production shops. In cylindrical grinding, the machine that takes the spotlight for the finest inch-splitting job at the lowest cost of production is the CINCINNATI FILMATIC Micro-Centric Grinder. Many shops equipped with Micro-Centrics are now producing higher quality parts . . . within 25 millionths diameter tolerance and 25 millionths square with one face . . . at the low cost associated with high production equipment. ¶Anti-friction bearing races and rings are naturals for the Micro-Centric method of grinding. Sizes of these parts vary from miniature bearings for instruments to the large rings being ground on the extended range Micro-Centric shown here. Perhaps parts for other components, even though squareness of face is not required, could be Micro-Centric ground to far higher standards of quality and at lower cost. It's well worth consideration by your methods engineers. And speaking of methods these machines may be equipped for:

Automatic loading

Automatic wheel truing with counter device

Automatic size compensation

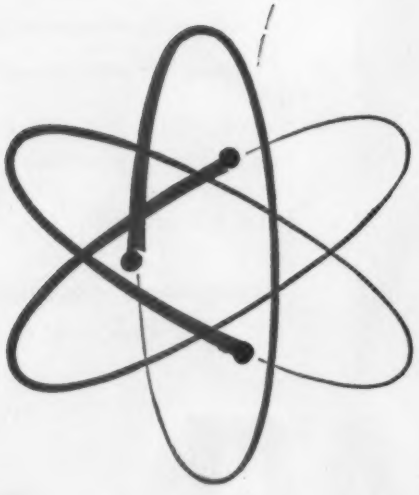
Does the Micro-Centric method of grinding look interesting for your shop? Our grinding specialists will be glad to help you decide. Write for more information.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

CINCINNATI

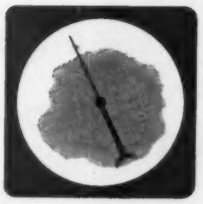
CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

FINE



THE
PRECISION
LINE

PITCH



THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATRE

AT THE SHOW...
Booth 1416

At the Show see the "new look" in Fellows fully integrated line of production and inspection equipment for fine pitch precision gears. See it in action, and you will agree, nothing can match it! Just in case you don't make it to the Show... better check your nearby Fellows Office for information about the most recent developments.

THE FELLOWS GEAR SHAPER COMPANY
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Fellows *Gear Production Equipment*

EXTRA!
EXTRA!

VAN NORMAN ANNOUNCES

New Ram Type Miller No. 16S

Features

QUILL Adjustable CUTTERHEAD

Gives Work-Ability of Two Single Purpose Milling Machines...

PLUS...

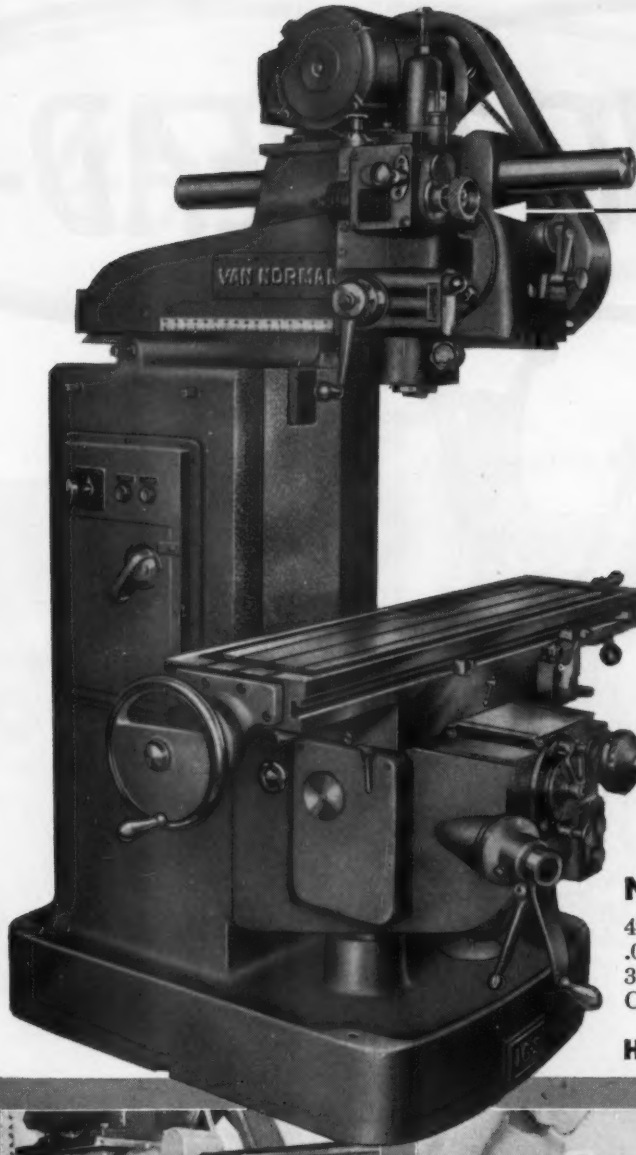
Accurate Boring and Drilling with the Same Machine without Attachments

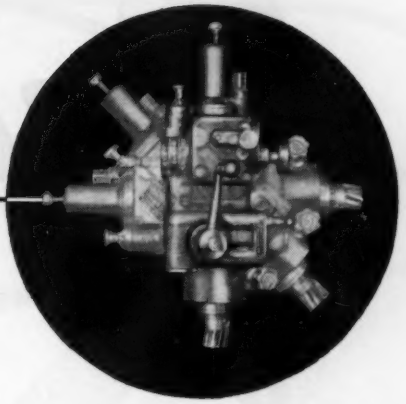
Don't wait . . . for extra profits install a Van Norman now! They are available on five purchase plans — Outright sale . . . Purchase on conditional sales contract up to 5 years . . . Pay as you depreciate . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company.

Lease and Conditional Sales Contracts not available to Export

VAN NORMAN

MANUFACTURERS of—Ram Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.





Quill Adjustable Cutterhead makes the No. 16S the most Versatile Miller Available

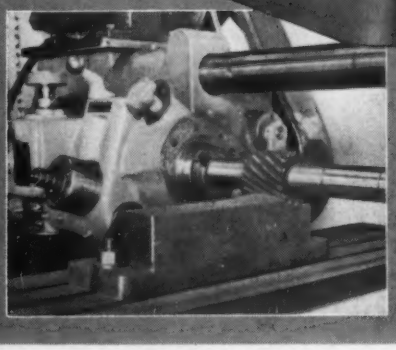
Permits Horizontal, Angular and Vertical Milling, Boring and Drilling on ONE MACHINE.

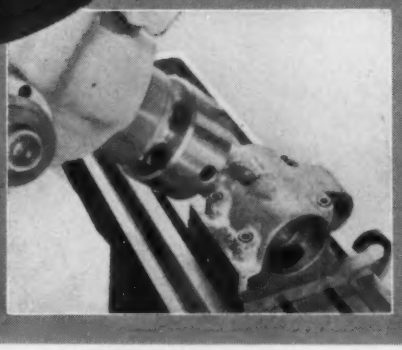
Phone, wire or write for more information and catalog giving complete details.

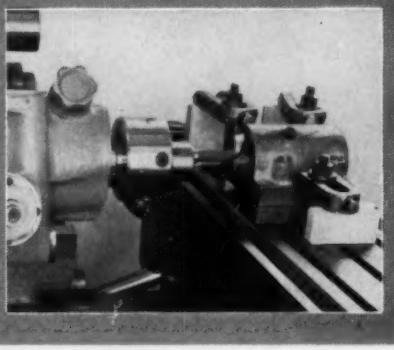
No. 16S...

4″ Quill Travel; 3 Quill Feeds; .0015, .003, .006; 8 Spindle Speeds; 110 to 3600 RPM; Table Size 40½″ x 10″; Cutterhead Spindle Motor 2 HP

HERE'S HOW IT WORKS...







A HORIZONTAL MILLING

A horizontal milling cut performed on a cast iron base. Width of cut 2¼″; Depth .25″; 3″ wide helical slab milling cutter; Speed 110 RPM; Feed 6 IPM.

ANGULAR BORING

Angular boring on a cast iron saddle bracket boring a 1″ dia. hole. Depth of bore 1¾″ removing ⅛″ stock on roughing cut. Finish cut removes .010″; Tolerance on I.D. .001″.

HORIZONTAL COUNTER BORING

Horizontal counter boring operation of a 3″ dia. hole on same saddle bracket. Depth of cut 1″ to a shoulder removing approximately ⅛″ on rough cut. Finish cut .010″; tolerance on I.D. .001″.

COMPANY

SPRINGFIELD 7, MASSACHUSETTS

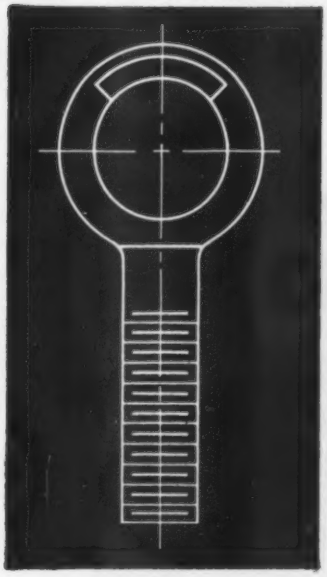
A redesigned model of this equipment in operation at:

THE MACHINE TOOL SHOW BOOTH 1406

LANDIS *Machine* CO.

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF THREAD

—45.5% of Former Cost!

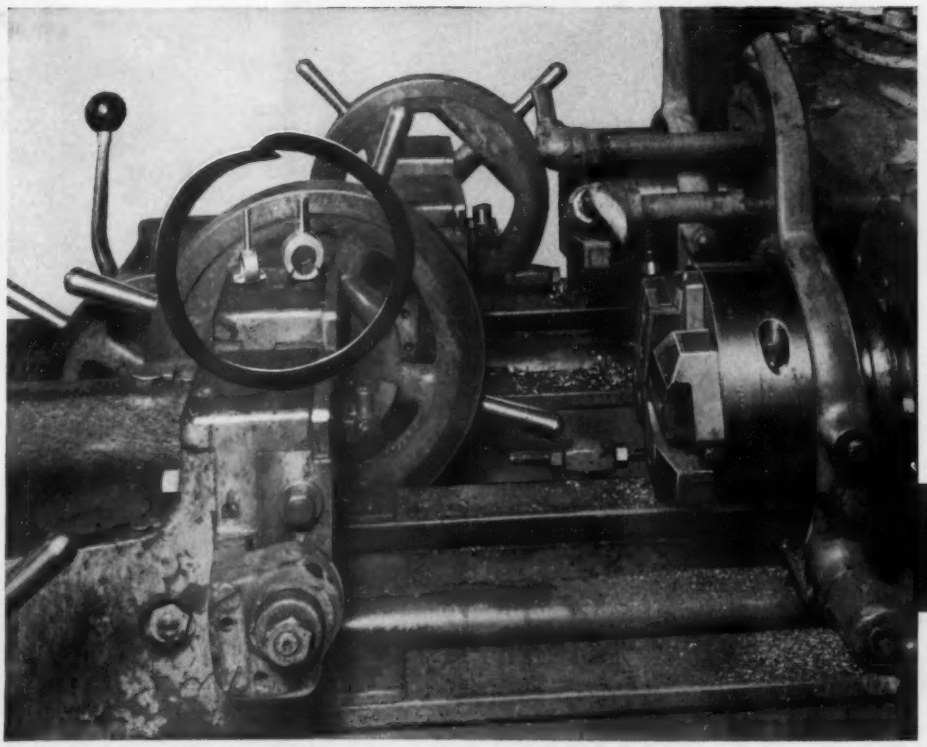


Eye bolts, for use in the assembly of switchgears, are now threaded on 1" Double LANDMACO Leadscrew Threading Machines in the Philadelphia plant of a large Eastern manufacturer. Records show that costs by previous methods averaged 120% higher.

Three sizes of eye bolts are threaded from high tensile bronze and copper castings—3/8", 1/2", and 5/8" 16, 13 and 11 pitch National Coarse threads respectively are cut for lengths varying from 15/16" to 1 5/8" at cutting speeds of 302 and 217 RPM's.

Lower tool cost has been an important factor in the overall cost reduction from threading these parts with LANDIS Equipment. Approximately 25,000 pieces are produced between each regrinding of the chasers. This combined with the fact that LANDIS Chasers are reground and used for most of their original length has brought tool cost down to a minimum.

This is one of many examples where LANDIS Threading Equipment has significantly reduced operating costs—others show increased production, better quality, lower maintenance, etc. Further information on LANDMACO Leadscrew Machines and all LANDIS Threading Equipment will be furnished promptly on request. Please give specifications when writing.



LANDIS

WAYNESBORO PENNSYLVANIA

GENERATING EQUIPMENT

One Machine for all these grinding jobs

Landis Universal and Tool Grinder

LANDIS

precision grinders

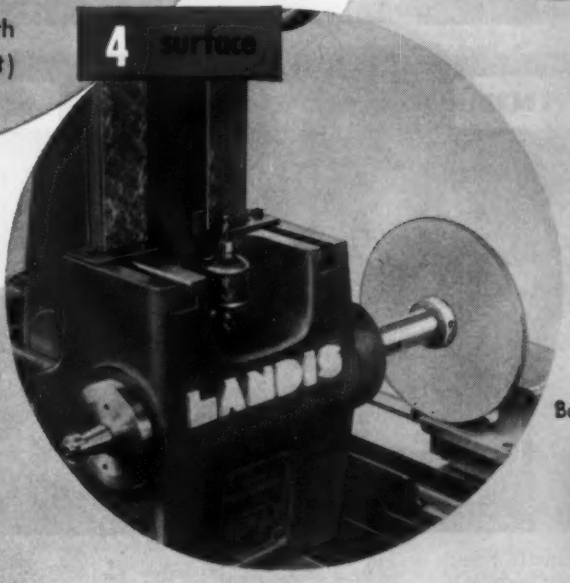
Landis 12" x 28" Universal and Tool Grinder —two machines in one—a tool grinder and a universal grinder. Catalog K - 53

LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U. S. A.

Also sharpens these tools:

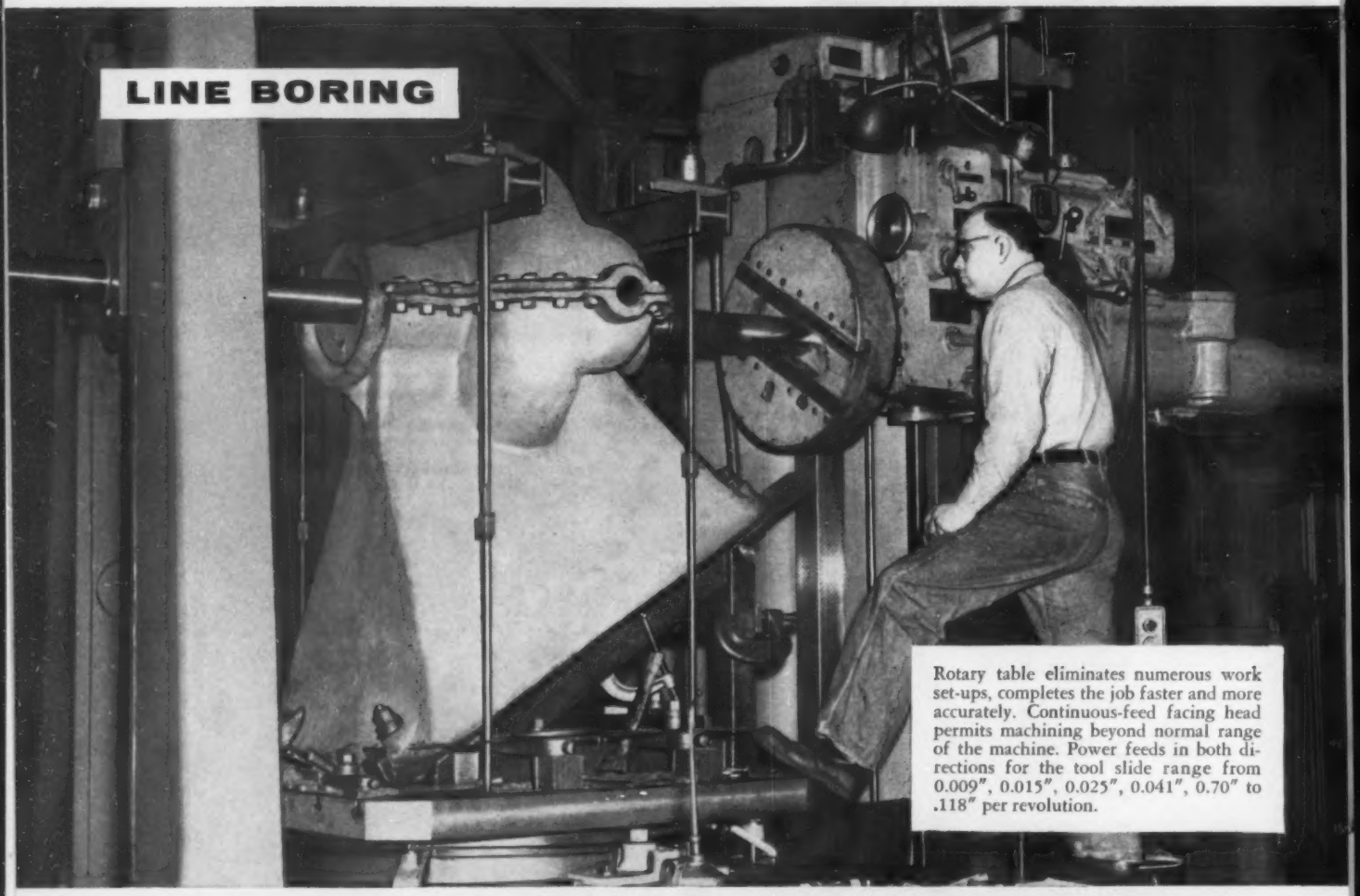
- Taps
- Formed cutters
- Spiral mills
- Milling cutters
- Hobs
- Forming tools
- Gear cutters
- Face mills
- End mills
- Drills
- Saws
- Reamers

(All operations can be done with standard and extra equipment)

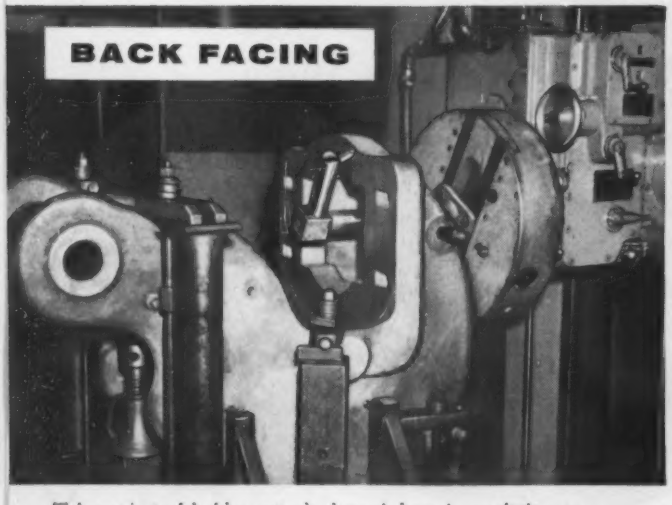


Booth 1117

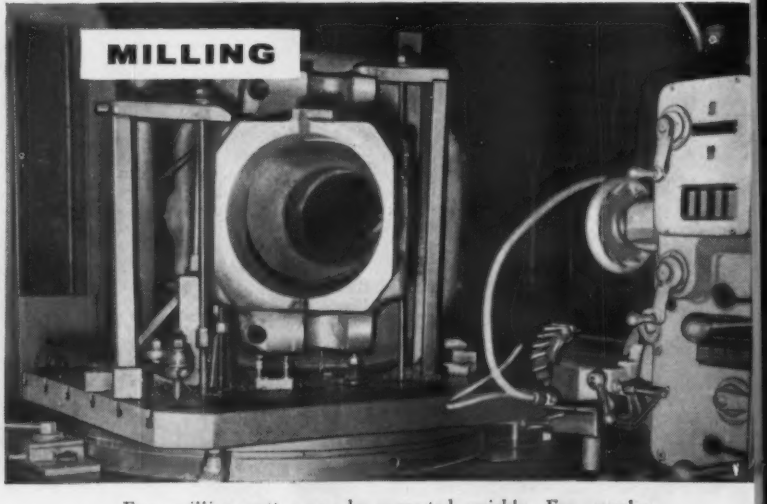
Look at all the operations performs with a



Rotary table eliminates numerous work set-ups, completes the job faster and more accurately. Continuous-feed facing head permits machining beyond normal range of the machine. Power feeds in both directions for the tool slide range from 0.009″, 0.015″, 0.025″, 0.041″, 0.70″ to .118″ per revolution.



Telescopic tool holder extends through bore in workpiece to hold cutter for back facing operation.



Face milling cutter can be mounted quickly. For angular milling a G&L attachment can be used.

Wilmot Fleming single G&L machine

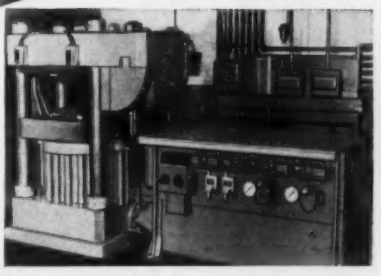
THE MACHINE TOOL SHOW — BOOTH NO. 710

Here's how to tool-up and set-up workpieces to boost production and profits with a Giddings & Lewis 340-T horizontal boring, drilling and milling machine

Most versatile and busiest machine in the shop of Wilmot Fleming Iron & Steel Co., Philadelphia, Pa. — that's the Giddings & Lewis Model 340-T, horizontal boring, drilling and milling machine. Its ability to increase production, save many man-hours and boost profits, permits this manufacturer to perform a considerable amount of subcontract work. This is in addition to production machining of their own product lines.

With G&L's continuous-feed facing head, rotary table and 45 spindle speeds that are easy to select and change, the Model 340-T enables the operator to perform a broad range of machining operations . . . apply heavier cuts and faster cutting speeds.

Compare this 30 Series machine with any other in its class! You'll discover that feature-for-feature — dollar-for-dollar — you can't buy better.



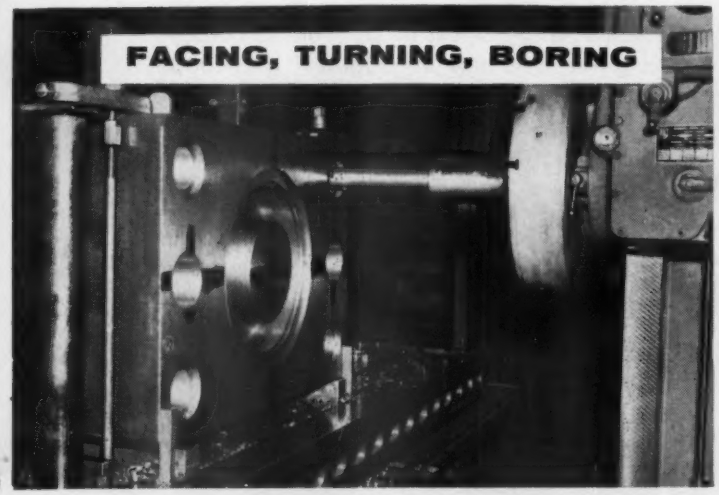
Large and small components of Wilmot Fleming's hydraulic press are precision-machined on G&L's 340-T.

Builders of the world's finest heavy-duty machine tools — Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers; Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools.

GIDDINGS & LEWIS MACHINE TOOL CO.

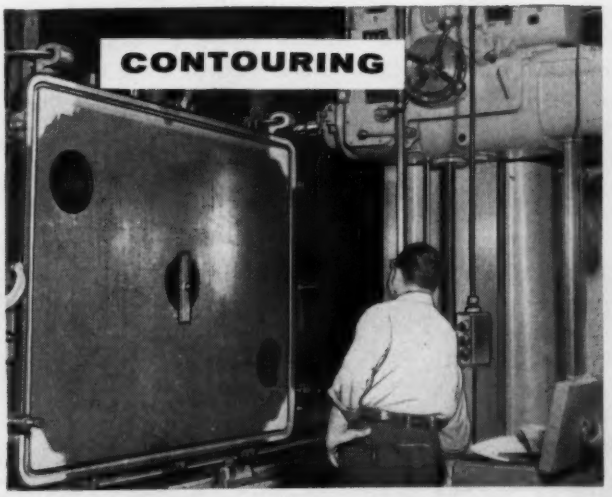
FOND DU LAC, WISCONSIN

FACING, TURNING, BORING



With a continuous-feed facing head, facing, turning and boring operations are performed on one set-up.

CONTOURING



True directional control for contour milling is accomplished manually or through power feed.

Announcing VK MICROGAGES

.000008" ACCURACY

81-BLOCK SET
$250.00

30% *more wear surface than rectangular blocks*

Two really new and important facts should be noted in this announcement by Van Keuren: the closer tolerance of ±.000008" on VK Microgages, and the 81-block combination of ⅞" diameter longer-wear gages . . . now available for the first time.

These fine quality precision gage blocks by Van Keuren are products of the same machine-lapping and inspection techniques as Van Keuren Rectangular and Solid Square gage blocks. Size tolerance as already noted is guaranteed, as well as a maximum surface roughness of 1.4 RMS. Because their round shape provides greater wear surface, Van Keuren Microgages can be depended on for longer life and lower cost. Their closer tolerance has been particularly developed to meet today's demands for more exacting precision in shop work.

In addition to the new 81-block closer tolerance set featured here, Van Keuren offers 15 other standard sets of Microgages; also Solid Square type sets of gage blocks in .000004" accuracy and Rectangular type sets in .000004" and .000008" accuracy. For further information address: The Van Keuren Co., 173 Waltham St., Watertown, Mass.

"Quality in Millionths"

VK
36th YEAR

THE *Van Keuren* CO.,

173 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires • Chrome Carbide Taper Insert Plug Gages

Change in Grain Size and Structure Cuts Abrasive Costs 80%

Grizzly Manufacturing Division grinds 5½ times more brake lining per disc

An 80% cut in abrasive disc costs in grinding brake lining is reported from Grizzly Manufacturing Division of Paulding, Ohio.

Looking for ways to cut costs, their production men called in the Gardner Abrasive Specialist. Could Gardner make discs that wouldn't wear out so quickly?

The new Gardner disc stepped up production from 454,790 to 2,512,200 feet of lining per disc. That's 5½ times more production for each disc! Downtime for disc replacement has been turned into productive time.

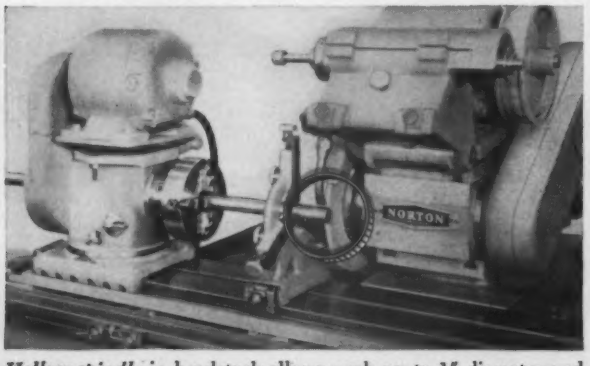
125A

GARDNER

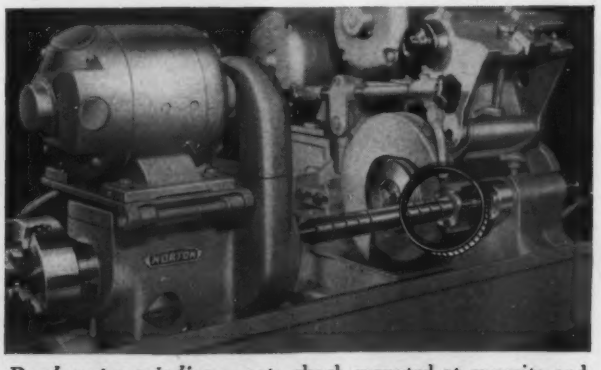
abrasive discs

BELOIT, WISCONSIN, U.S.A.

He can change-over fast from this internal grinding set-up on the Norton 10" x 20" Universal grinder. The internal grinding spindle, permanently hinged to front of wheel side, swings up out of the way — and he's ready for external, face or angular wheel slide jobs.



Hollow spindle in headstock allows work up to 1" diameter and longer than machine to be passed clear through.



Dead center grinding — note chuck mounted at opposite end of head, a real set-up time saver.

Quicker set-ups here...

THE MACHINE TOOL SHOW CHICAGO, ILL.

increase your profit margin

on many different grinding jobs

Norton 10" x 20" and 10" x 24" Universal Grinding Machines are famous for versatility, accuracy and fast, smooth performance

Do you want to save valuable time on many grinding jobs? Want a multi-purpose machine for rough cuts or finest precision finishing?

Then you want the Norton 10" x 20" or 10" x 24" Universal Grinder . . . that helps you produce more work at less cost.

The Norton 10" Universal is a multi-purpose grinding machine that can do external, internal, face and angular wheel-feed grinding.

Head and footstock are interchangeable, permitting simplified set-up on jobs involving shoulders or spacers, especially on angular grinds. Set-ups are made easier on chucking jobs by the D1-3" camlock nose on one end of the headstock spindle, and the provision for permanent chuck mounting. The headstock is easily swivelled 180° to change from dead center to chucking work.

The wide versatility of this machine proves once more that you economize when you modernize with a new Norton machine. For complete information see your Norton representative or write for Catalog 170-3. NORTON COMPANY, Machine Division, Worcester 6, Mass.

To Economize, Modernize With NEW

NORTON

GRINDERS and LAPPERS

Making better products. . . to make other products better

District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit
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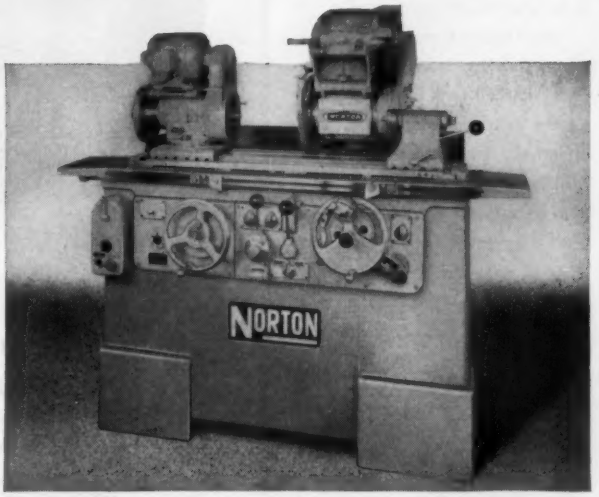
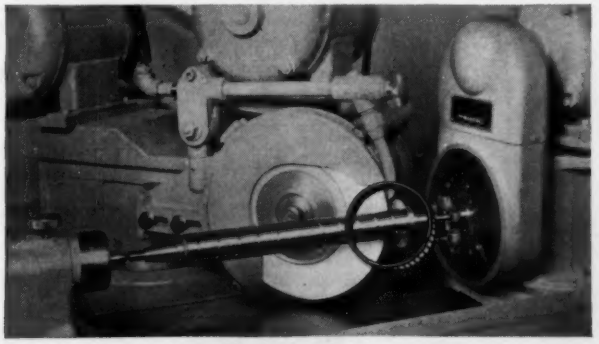
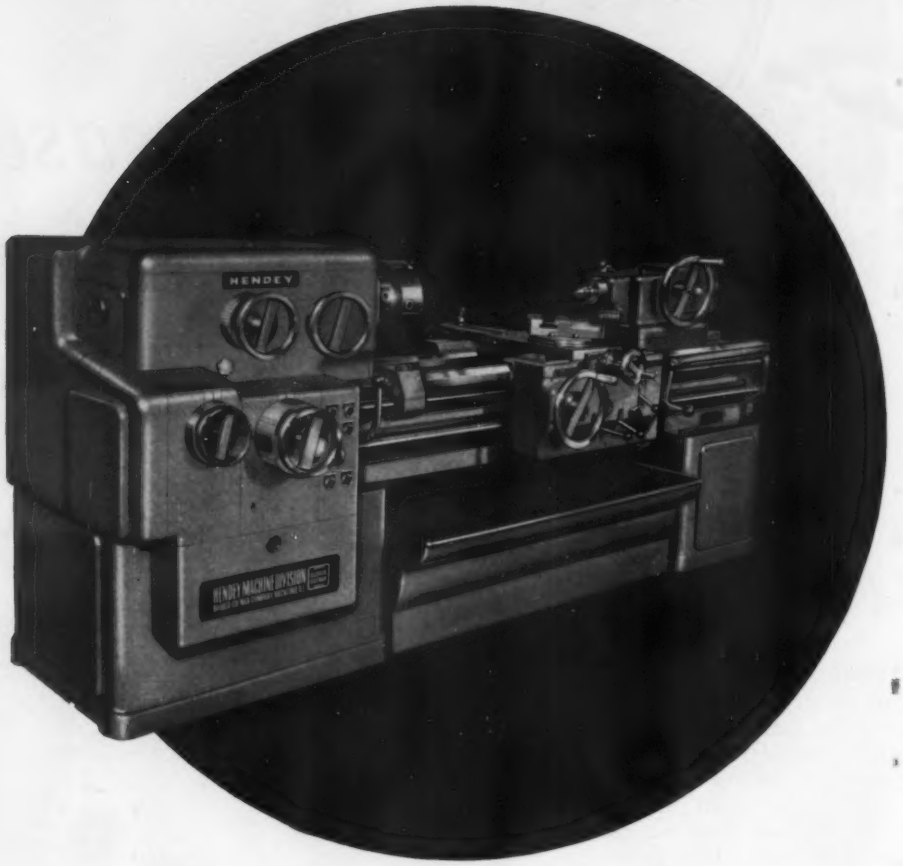


Norton 10" x 20" Universal Grinding Machine. Wheel head swivels 360°. Internal spindle hinged to front of slide and swings up out of way when grinding external work.



Head and footstock are reversible. No need to change wheel and drive to the other end of spindle.

two new Hendey lathes...



32-Speed Geared Head Lathe

This completely new lathe has a 32-speed headstock with the top eight speeds obtained through a belt drive to assure smooth finish on the work. This machine is equipped with a 15 HP motor, and spindle speeds up to 1500 RPM are available. It is designed to accommodate a 20 HP motor for spindle speeds to 2000 RPM. It can be furnished in 13", 16" and 20" sizes. Exclusive induction hardened and precision ground bed ways provide maximum accuracy and long life. Other features include 66 thread and feed changes, an independent lead screw, automatic lubrication, high-speed reversing mechanism, precision automatic stops, and heavy-duty, two-speed tail stock.

THE MACHINE TOOL SHOW

See them in action in Booth No. 221

for greater accuracy and production

No. 2E Precision Lathe

The new No. 2E Hendey Lathe is a 14" general-purpose precision lathe equipped with "Selectronic" control of spindle speeds. The electronic unit provides closer control over cutting speeds and full torque at slow speeds. It is an exclusive Hendey feature and is custom built for this lathe. Speeds may be pre-set or changed while cutting, and they are infinitely variable from 15 RPM to 1500 RPM. Low speeds are available through back gears. The spindle starts, stops, and reverses with a single lever control. Other features include dynamic braking, automatic lubrication, precision spindle bearings, and hardened and ground bed ways.

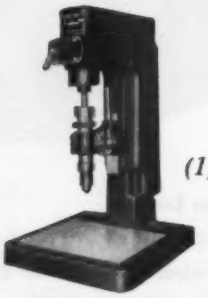
These new modern lathes are Barber-Colman's answer to any questions concerning the future of the Hendey line. They are proof of the strides we have already made and indicate the continued progress which we guarantee in the future. For years Hendey has had a reputation for accuracy. Now, new machines and features provide even closer limits of accuracy and greater production. Electronic and magnetic amplifier drives, induction hardened and precision ground bed ways, and a 32-speed geared head-stock are only a few of the new features available on Hendey lathes. See these new machines in action to determine how they can fill your production requirements.

Hendey **machine division**
BARBER-COLMAN COMPANY
115 LOOMIS ST., ROCKFORD, ILLINOIS

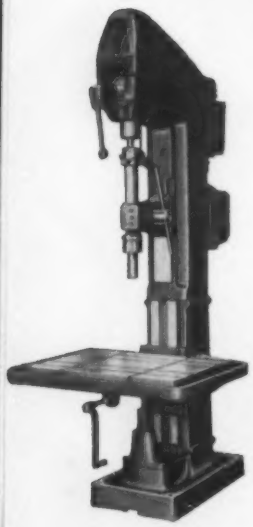
BARBER COLMAN

Avey has the right one

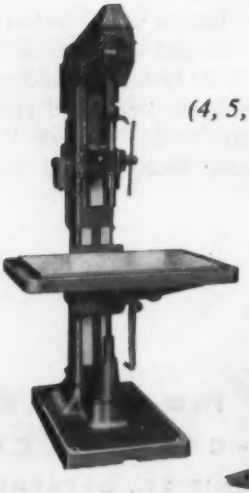
(7) Super 8 spindle

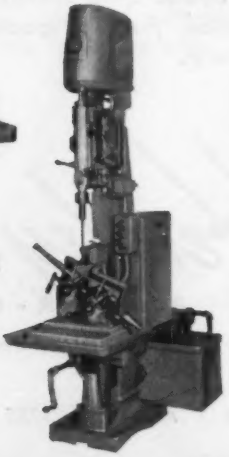


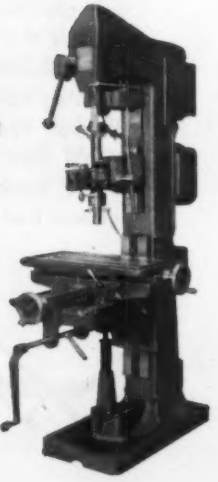
(1) Bench type



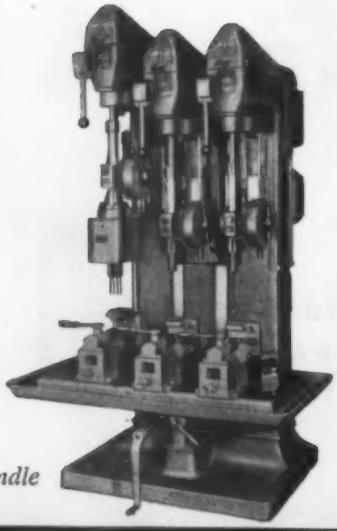
(2) Column type







(4, 5, 6) Tool room drills



(3) Multi-spindle

Whatever your light and medium duty drilling needs, it's a sure bet that the machine you need is made by Avey. The whole Avey line would pack this magazine with pictures —would give you every combination of size, capacity, speed, overhang, and table arrangement to fit your requirements. The ones shown will give you the general idea. Write for literature.

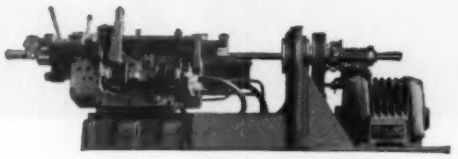
(Figures 1 through 6) Standard Drilling and Tapping Machines. Capacities in cast iron from very small numbered drills to 1½″; 6 or 8 speeds up to 12,000 rpm; No. 32 Jacobs chuck to No. 4 Morse taper; 4 feeds; 1 to 6 spindles; column or bench type; wide range of swing. Featuring such "bonus" advances as micrometer stop collar; telescoping spindle guard; dynamically balanced rotating parts; rack and pinion operated motor plate; large tool and die shop tables; and Avey's pace-setting spindle construction.

(4, 5, and 6) Avey tool room drills, built in No. 2 and No. 3 BMA-6 sizes. Large table 34″ x 25″; round table 18″ diameter; compound table 25″ x 12″.

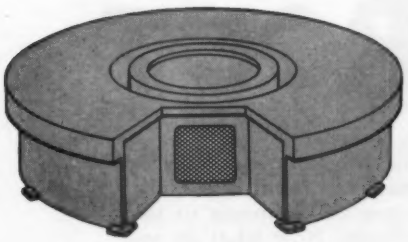
(7) Super 8 Spindle Drilling and Tapping Machine. No. 2 Morse taper. Power lift to table by push button control. Hand feed, power feed, lead screw tapping. Four feeds, 6 speeds. Built-in coolant system.

for Avey makes them all

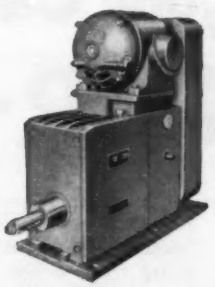
Avey



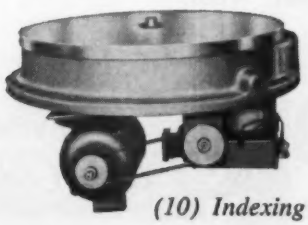
(9) Avey-draulic



(11) Standard base



(8) Cam feed unit



(10) Indexing table

(8) Automatic Cam Feed Units. For drilling, tapping, reaming, hollow milling. Vee belt or gear drive. Nos. 1, 2, and 3 Morse taper. Capacity in cast iron: No. 1, ½″; No. 2, 1″. Mount at any angle. Fully or semi-automatic. Self-contained, tamper-proof.

(9) Avey-draulic feed unit. Automatic withdrawal for chip removal only when necessary during deep hole drilling. Rapid advance, feed, and rapid return. Jump feed attachment available. Standard strokes 12″ up to 30″. Avey's patented Torque-matic control optional.

(10) Automatic index tables. Rapid, accurate indexing to .001″. Even or uneven index patterns obtainable. 16″ to 48″ diameter. All adaptable to Avey standard bases.

(11) Steel Bases. One of Avey's standard line of fabricated bases. Stress relieved, sandblasted, machined, and painted to fit your application. Combine 8, 9, 10, and 11, and you get fast returns on your investment, and a step ahead of your competition!

THE AVEY DRILLING MACHINE CO., CINCINNATI 1, OHIO

drilling, tapping, production machines

This Small Counter
Does a Whale of a Big Job!...

Added Evidence that —

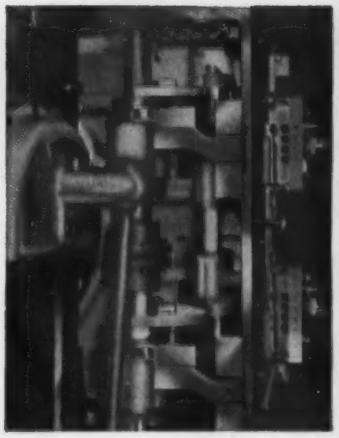
Everyone Can Count on VEEDER-ROOT

For its size . . . *less than one inch square* . . . this Veeder-Root Small Square-Case Counter is the most rugged instrument of its type, with the longest accurate life. And only Veeder-Root makes it this way . . . square all the way through . . . extra strength built-in, with bearing surfaces on *both* ends of the drive shaft.

What's more, this counter is 100% American . . . made by Connecticut craftsmen to unmatched standards of quality and precision. And it's the "counter of countless uses" . . . built into everything from office machines and cameras to taxi meters and voting machines. Now what do *you* make that could count its way to bigger sales and profits with a Small Square-Case Counter built-in as a standard part? Write:

VEEDER-ROOT INCORPORATED
HARTFORD 2, CONNECTICUT
Chicago 6, Ill. • New York 19, N. Y. • Greenville, S. C.
Montreal 2, Canada • Dundee, Scotland
Offices and Agents in Principal Cities

'The Name that Counts'

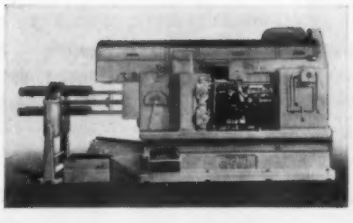


Conomatics Provide Radial Screw Adjustment of Forming Tool Slides

- Models 2⅝" LA, 3½" AD, 5" KL, and 5¼" KR Conomatic Four Spindle Bar Machines are equipped with a number of quick job-change features. One of these is the all-position end attachment drive for the mounting of endworking opposed spindles in all positions, with independent feed to as many as three opposed spindles on a single setup.

Another feature that is of considerable importance in tooling up is the radial screw adjustment of all sideworking slides. Trial cuts may be taken to correct diameters with form tools without changing the clamped positions of the form tool holders.

All Conomatic quick changeover models are equipped with dial adjustment of the working stroke of all tool carrying slides. Besides the Four Spindle machines there are three quick change Six Spindle models in 9/16", 1" and 1⅝" sizes.
Write, wire, or phone for literature.



Conomatic

THE MACHINE TOOL SHOW CHICAGO, ILL. BOOTH 401

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.

Shearing Stainless Steel on a 10-foot Niagara shear with a maximum capacity of 10 gage carbon steel and 13 gage Stainless Steel.

Shop talk on cutting Stainless Steel

for best results... more power and slower speeds

• Cold cutting of Stainless Steels presents no fabricating problem when you recognize the basic differences that exist between these strong, corrosion-resistant materials and mild steels.

Since Stainless Steels are tougher than mild steels, experience has shown that they require from 30% to 50% more force to shear. Shear blade should be ground with as much lip clearance as possible and must be maintained sharp and set close. The austenitic grades are work-hardenable and require an especially close blade adjustment.

Blanking and punching calls for the best grades of tool steel with punches and dies kept sharp. More power will be required than for plain carbon steel and slower speeds are advised.

In perforating, twice the power should be used for Stainless Steels and the press speed reduced to one-third or one-half of that used for mild steel. For austenitic grades, clearances should be especially close. Holes should not be smaller in diameter than the thickness of the metal used; for austenitic grades, a minimum of 1½ to 2 times the thickness of the metal.

For complete information on all phases of fabrication of USS Stainless Steel, write for your copy of our "Fabrication" book. Our representatives, too, will be glad to assist you with your shop problems. For your copy of the book, write to United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

SEE THE UNITED STATES STEEL HOUR. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

UNITED STATES STEEL CORPORATION, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
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USS STAINLESS STEEL

USS

SHEETS • STRIP • PLATES • BARS • BILLETS
PIPE • TUBES • WIRE • SPECIAL SECTIONS

5-424

UNITED STATES STEEL

Announcing:

The B-11 — A great new Norton resinoid bond

More uniform, better balanced **B11** *wheels bring you "TOUCH of GOLD" advantages to your heavy weld grinding*

Joining the list of famous Norton bonds that have made grinding wheel history, the new B11 resinoid offers important new performance-benefits to heavy weld grinding applications. Here's why:

New processing developments have greatly improved the uniformity of structure and therefore the balance of B11 wheels. As a result, they "hug that work" closer, grind cooler and faster, with far less vibration and bounce. For you, this more efficient grinding action adds up to such typical Norton "Touch of Gold" benefits as: better product appearance, less operator-fatigue and longer wheel life.

In addition, you get closest possible duplication with B11 wheels. Hardness increments are evenly spaced throughout the entire grade scale. And to make it even easier for you to choose exactly the right wheel for every job, B11 wheels can be supplied in half-grade increments.

See Your Norton Distributor

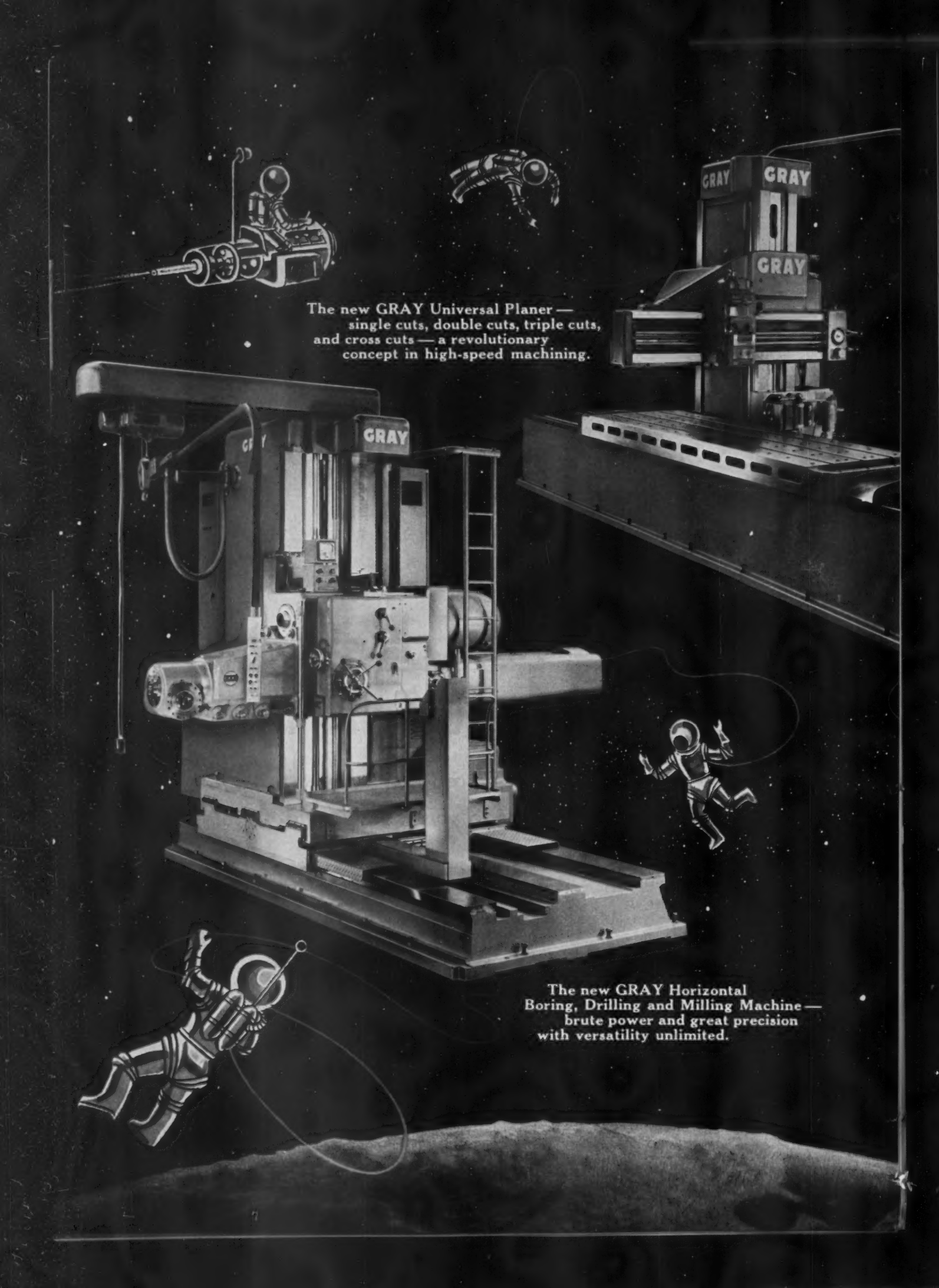
for details on the new B11 resinoid bonded wheels. Or write to us direct. And remember, only Norton offers you such long experience in both grinding machines and wheels to help you produce more at lower cost. NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts. W-1666

NORTON

Making better products... to make your products better

and its BEHR-MANNING division

NORTON COMPANY: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes



The new GRAY Universal Planer — single cuts, double cuts, triple cuts, and cross cuts — a revolutionary concept in high-speed machining.

The new GRAY Horizontal Boring, Drilling and Milling Machine — brute power and great precision with versatility unlimited.

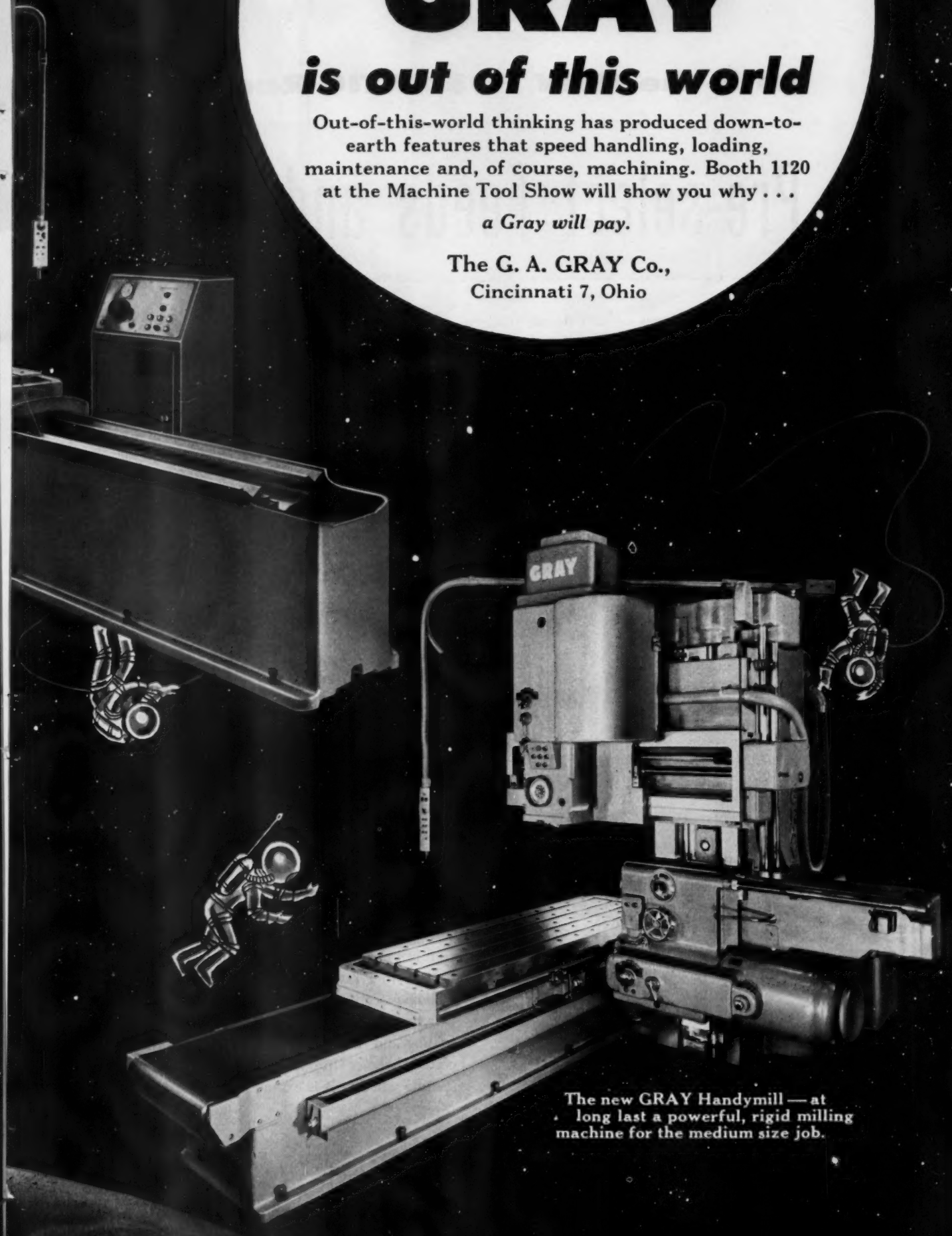
GRAY

is out of this world

Out-of-this-world thinking has produced down-to-earth features that speed handling, loading, maintenance and, of course, machining. Booth 1120 at the Machine Tool Show will show you why . . .

a Gray will pay.

The G. A. GRAY Co.,
Cincinnati 7, Ohio



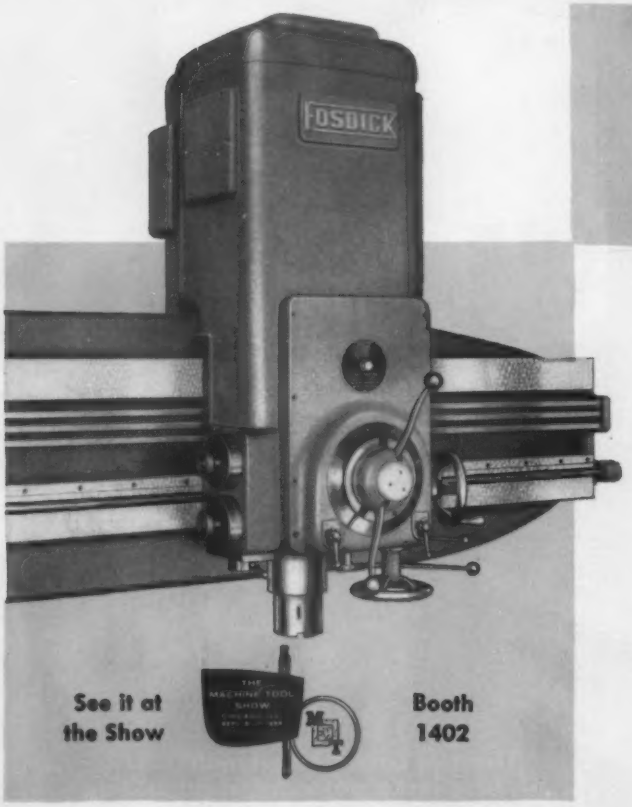
The new GRAY Handymill — at long last a powerful, rigid milling machine for the medium size job.

With the NEW FOSMATIC Radial Drill

Pre-select Feeds and Speeds

All the new features needed by the modern machine shop have been designed into the new Fosmatic Radial Drill. Pre-selected feeds and speeds for a new degree of speed and operator convenience. Spindle speeds up to 3000 rpm to suit today's high-production requirements. Engineering refinements throughout to give you the rigidity you need for fast precision drilling.

Feeds and speeds are selected on dials at left side of the head, usually while waiting for a drilling operation to be completed. Shifting is accomplished by raising the spindle control lever slightly in its neutral position. Feed is engaged by pressing a button on either of the quick-return handles; feed is disengaged either by depth control or pressing one of the buttons. Other convenient controls at the head – Single lever elevates arm or traverses head (hydraulic variable rapid traverse). Hydraulic column clamp. Hydraulic arm clamp, safety-interlocked with elevating lever. Hand feed and traverse to the head. The tool ejector eliminates need for tang driver.



• • • • Drill with

Smooth running, high precision and extra rigidity make the new Fosmatic outstanding among Radial Drills. Case-hardened gears are ground on the finest equipment available. They run on ground splined shafts which are mounted in ball bearings. Lubrication is automatic.

Thirty-six spindle speeds with a maximum of 3000 rpm are available in a variety of ranges, each with a 127.5 to 1 ratio. The new boring-type spindle is of heavy section with bearings placed far apart for extreme rigidity; it can easily be used for boring, milling and the heaviest drilling. A new and unique counterbalance produces equal tension on the spindle whether it is extended or close to the head.

NEED DRILLING EQUIPMENT? GET A PROPOSAL FROM FOSDICK!

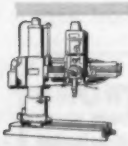
Speed, Ease and Precision

For more efficient tapping, reverse spindle speed is 40% faster than forward speed.

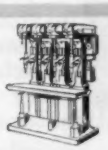
Our new arm is probably the strongest in the business. It has a double boxed section with very heavy walls; ways have been widened considerably. The head is mounted on roller bearings on hardened and ground ways with an additional roller support in back of the arm. Safety nut is hydraulic. Column is superfinished.

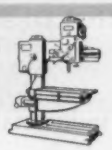
Eighteen feeds are available, including 5 tap leads, from .003" to .125". Feed engagement is through a powerful magnetic clutch which will never require adjustment. The feed dial is graduated to full spindle travel to eliminate resetting for deep holes. Electronic milling feeds are also offered — from ¾ to 15 ipm.

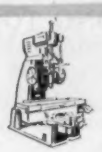
Standard sizes available with 4' to 8' arms, 13" to 19" columns.


Radial Drills

Jig Borers


Sensitive and Upright Drills


Sensitive Radial Drills


Automatic Positioning Machines

FOSDICK

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

ARMSTRONG

The ARMSTRONG Threading Tool takes interchangeable high speed steel form-cutters which require only flat top grinding to resharpen—always hold their true thread form.

Write for catalog

Each year ARMSTRONG TOOL HOLDERS become more important to you

Every rise in labor costs, every added tax, every overhead burden, every increase in cutting steel prices, every new, more costly machine tool, all increase the importance of ARMSTRONG TOOL HOLDERS to profitable operation.

ARMSTRONG TOOL HOLDERS reduce direct tooling costs to an absolute minimum—"Save: All Forging, 70% Grinding, 90% High Speed Steel."

ARMSTRONG TOOL HOLDERS reduce tooling-up time to minutes, to the selection and adjustment of the holder and cutter.

ARMSTRONG TOOL HOLDERS permit increased speeds and feeds—produce more pieces per hour per machine tool.

ARMSTRONG TOOL HOLDERS are efficient for they embody a perfection gained by over 50 years of specialization in the development and refinement of tool holders.

ARMSTRONG TOOL HOLDERS are inexpensive because they are quantity produced by modern methods, for a world market . . . are used by over 96% of the machine shops and tool rooms . . . are carried in stock for your convenience by all industrial distributors of consequence.

Buy **ARMSTRONG TOOLS** from your Industrial Distributor

See us at Booth #550 Metalworking Machinery & Equipment Exposition, Chicago Coliseum, Sept. 6-17

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"
5215 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

Production Pointers from GISHOLT

THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1938
INTERNATIONAL AMPHITHEATRE

BOOTH 1413

MASTERLINE
GISHOLT SINCE 1887

The Gisholt MASTERLINE medallion will identify this new and improved series of machines to be shown for the first time at the Machine Tool Show in Chicago in September. See them at work in Booth 1413.

PRE-SHOW ISSUE

SINGLE PASS *JETRACER* IS DOUBLE-TOOLED TO SPEED PRODUCTION

Unique Setup on No. 12 Automatic Lathe Cuts Costs on Differential Gears

Jobs like this may open your eyes to some new money-saving ideas with the Gisholt *JETRACER* unit. Here's how this manufacturer does it:

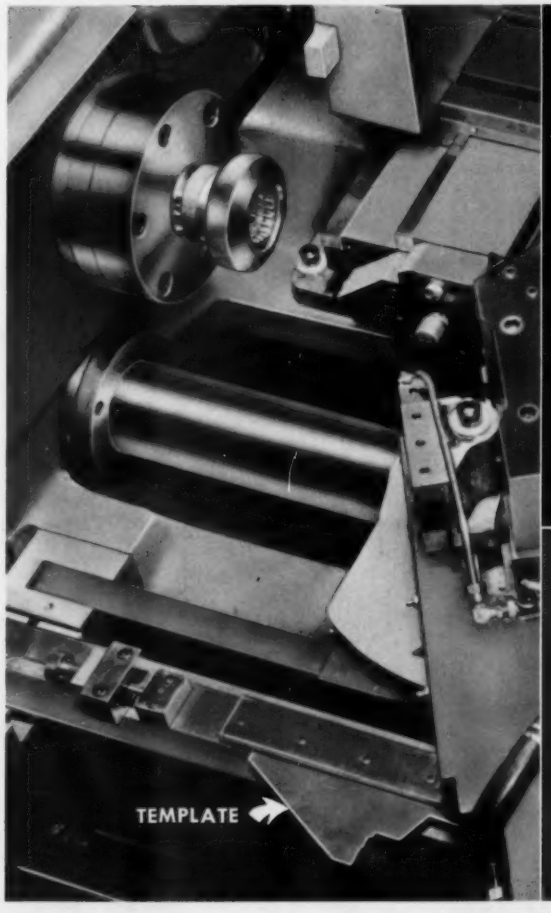
To machine steel forgings for differential gears, two No. 12 Automatic Lathes are equipped with *JETRACER* units, both of which are double-tooled. Gears are held on a segmented-sleeve type air-operated expanding mandrel and driven by a key in the splined I.D. Double-tooling on both tracer slides makes it possible to complete each operation in a single pass.

The line drawing illustrates the first operation. Tool "A" faces the bevel, chamfers the edge and turns the O.D. As tool "A" completes its cuts, tool "B" engages work, facing, co-boring, facing the co-bore and chamfering the corner of the splined I.D. Meanwhile, the rear slide feeds in with a single tool to face the back of the flange and shave-turn part of the hub. Floor-to-floor time is a fast 0.8 minute.

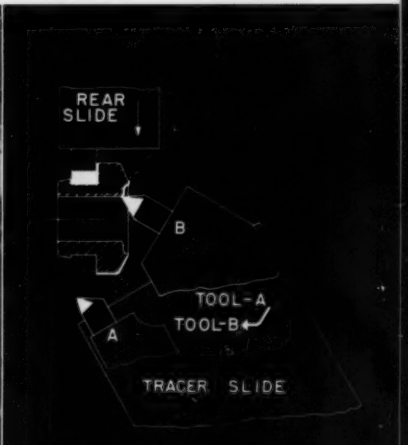
The second operation on the other end is completed in the same manner on the second No. 12 Automatic Lathe, also in 0.8 minute. One operator handles both machines to keep production humping.

It's the combination of smart tooling on the JETRACER unit with the speed of the No. 12 Automatic Lathes that accounts for the swift, accurate production of these parts.

(If you'd like to see more cost-cutting JETRACER *applications, ask for folder —Form 1171.)*



Machining of these differential gear blanks is done with setup shown in drawing. Tools on tracer slide engage in quick succession while simultaneous cut is made with rear slide. Note template for tracer follower at bottom of machine photo.



Layout for 1st operation

Work piece for 2nd operation

At the SHOW:

No. 12 and 24 AUTOMATIC LATHES—See single and multiple passes with *JETRACER* Unit. Three new models; one with full automation.

GISHOLT

TIME-SAVING IDEAS

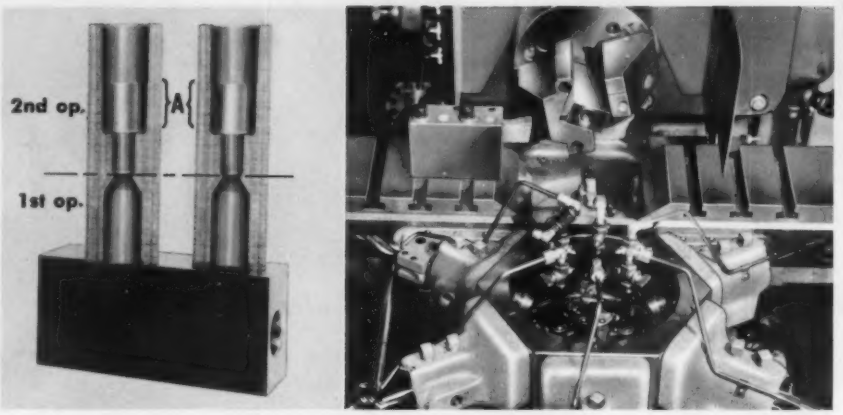
CUTS COSTS BY COMBINING INTERNAL MACHINING AND BURNISHING

Fastermatic Automatic Cycle Is the Answer

To cut costs on these steel block check valve bodies, the producer wanted them internally machined and burnished in two sequential operations on two 1F Fastermatic Automatic Turret Lathes.

By using a special two-jaw air chuck, the job was quickly and simply accomplished. Used for both operations, the special chuck has one stationary jaw, V-block shaped, to locate the work on center, with a dead stop at the rear for longitudinal location. The second jaw clamps the piece by moving in and out.

In the first operation, the valve seat is drilled, formed and reamed; the large bore is taper reamed; and the valve body is faced on one end. Time: 1.46 minutes. In the second operation, the other end of the piece is drilled, bored, co-bored, chamfered and reamed. The operation is then completed by feeding a special turret-mounted burnishing tool into bore "A" to obtain a 20 micro-inch R.M.S. finish. Time: 1.78 minutes.



With a minimum of special equipment, the Fastermatic incorporates the internal burnishing operation as part of the automatic cycle.

Total time for the first operation is only 1.46 minutes, and only 1.78 minutes floor to floor time is used for the second operation—including burnishing bore "A" to a 20 micro-inch R.M.S. finish.

AT THE SHOW:

FASTERMATICS—continuous automatic operation. New setup features make small lot production economical with simple, fast changeover.

TWO CHUCKS ON SADDLE TYPE LATHE HANDLE LONG WORKPIECES

Long oil well drill tubes machined quickly, easily with this setup

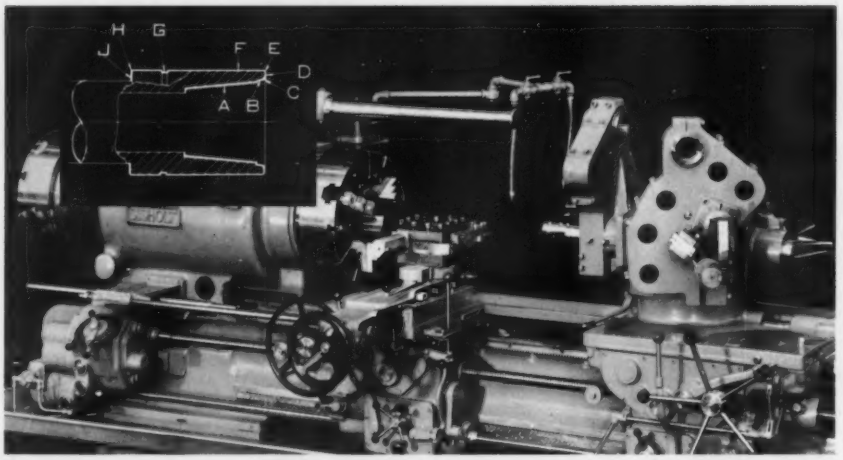
What's the fastest, easiest, safest way to hold an oil well drill tube and machine on end?

Here's one way of doing it:

The long tube is "double-chucked" in a 4L Saddle Type Turret Lathe, using two 24" 3-jaw scroll chucks, one at front and one at rear of the spindle. Result: whip is prevented; distortion is avoided.

Machining is low-cost and simple. First, "D" is faced from the square turret. Next, "A" is step-bored from two multiple-tooled stations on the hexagon turret, which also rough and finish co-bore "B," chamfer "C" and "E" and turn "F." Two more stations on the hexagon then rough and finish taper ream "A," and a special holder on the square turret simultaneously grooves "G," chamfers "H" and faces "J."

"A" is then single-point threaded, using the full-length lead screw and a special taper attachment cam on the square turret carriage. This completes the job.



Machining long workpieces without whip and distortion is simple, fast and easy with this two-chuck setup on a Gisholt Saddle Type Turret Lathe.

AT THE SHOW:

SADDLES—new higher speed, more powerful machines. *JETRACER* will be demonstrated on both bridge type cross slide and hexagon turret mounting.

THE SHOW . . . SEE GISHOLT!

THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 9-17, 1958
INTERNATIONAL AMPHITHEATER

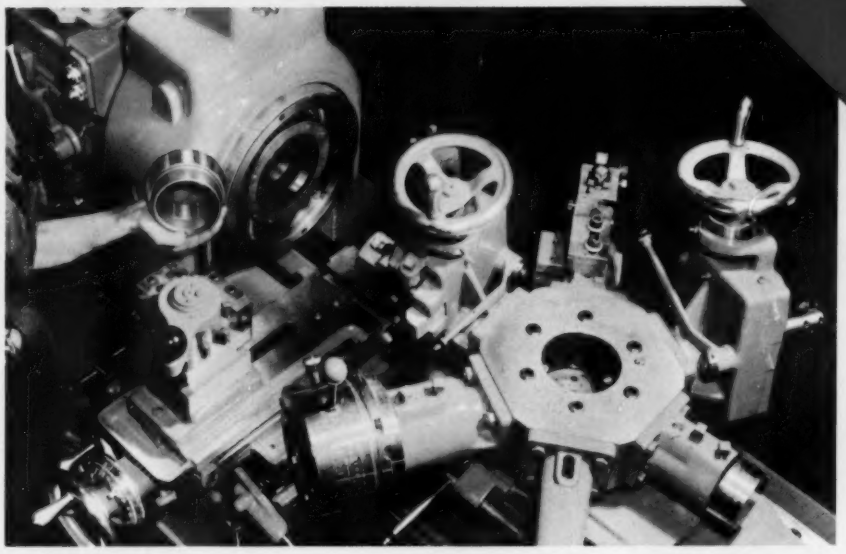
BOOTH 1413

HERE'S EXTRA SPINDLE BORE CAPACITY WITH OUTSIDE-OPERATED COLLET CHUCK

Here's a good idea to keep in mind: You can work right up to the limit of your spindle bore capacity. This producer is doing it with his Gisholt No. 5 Ram Type Turret Lathe, tooled to machine threaded adapter bushings from 4⅜" seamless steel tubing. An outside-operated collet chuck does the trick.

Tooling is also well planned. Parts are finished in minimum time—only 4.2 minutes floor to floor. Hexagon turret tools bore, co-bore, turn, form, chamfer, thread the O.D. and tap the I.D. Square turret tools face and chamfer with cut-off from the rear tool post.

An outside operated collet chuck arrangement provides the extra capacity needed to complete this job and permits using a smaller, less expensive machine.



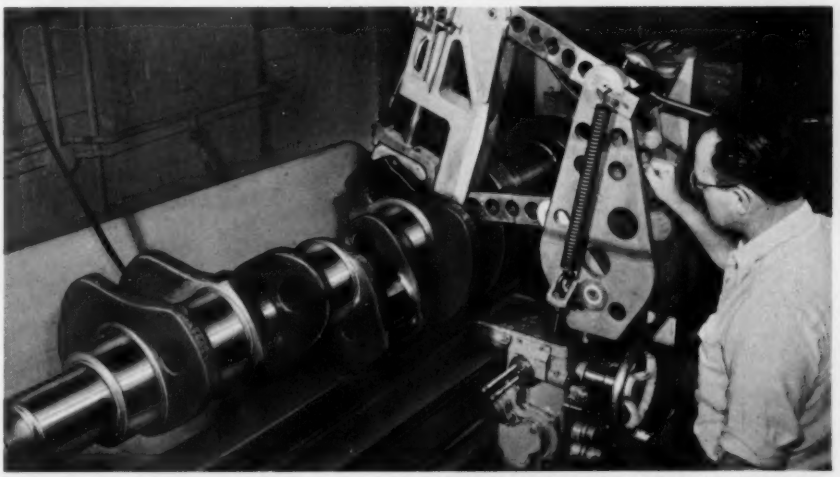
AT THE SHOW: See new Ram Type models, including the 4½" spindle bore No. 5. Also, first showing of the new Electram for high-speed, automatic operation on small parts.

HOW TO SUPERFINISH CRANKSHAFT BEARINGS ON A LATHE

No. 4 attachment makes possible smoother surfaces with very small investment

Even on limited production, you can take advantage of the benefits of Superfinishing. Attachments can be mounted on your own lathe, thus saving the cost of a special machine. In this case, large diesel engine crankshafts, main and pin bearings are Superfinished in one operation. Costs are held low by a Superfinishing attachment with a special latch-on type, follower-arm.

Nine bearing surfaces are Superfinished with four minutes stone contact time per bearing and one minute to position the attachment for the next bearing. A final surface finish of 3 to 5 micro-inches R.M.S. is attained, compared to 25 to 30 micro-inches R.M.S. before Superfinishing.



This special Superfinishing attachment on existing equipment eliminates polishing and lapping operations to insure better crankshaft performance.

AT THE SHOW:

SUPERFINISHERS—machines working continuous runs and job lots. Demonstrations to show reasons for Superfinish and how to control size.

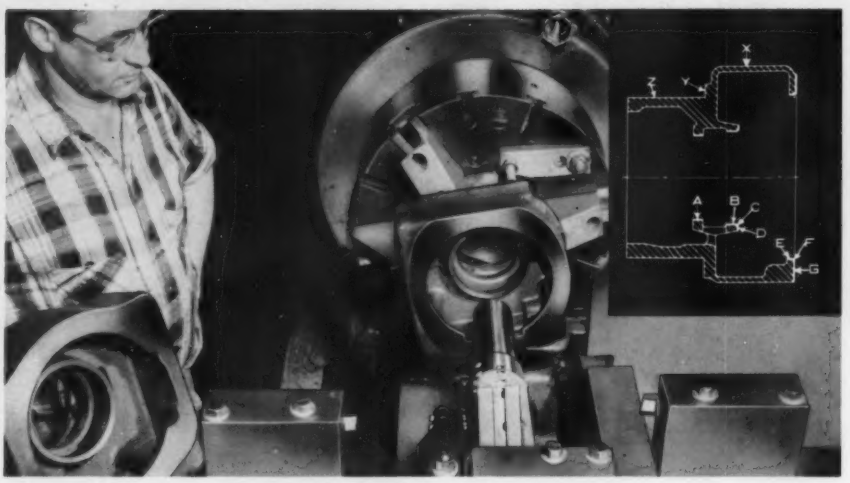
TALK TO GISHOLT ABOUT MACHINE TOOL LEASING

GISHOLT

AWKWARD GEAR HOUSINGS HANDLED EASILY THROUGH SMART TOOLING

TIME-SAVING IDEAS

Simplimatic setup with 9 tools, bores three diameters simultaneously



The manufacturer of a well-known farm tractor line had a problem in machining the awkward cast iron gear housing you see here. Smart tooling and the Gisholt Simplimatic Automatic Lathe are proving the answer.

The operator sets the rough workpiece on a special angle plate bracket providing a loading rest. This bracket also serves as a work-driver. Work is then placed against jacks at "Y" and chucked on the long hub at "Z" in a 3-jaw air chuck.

The center slide carries a piloted boring head. This is used for rough and finish boring "A," "B" and "E" as well as chamfering "C" and "F" and facing "D." When this work is completed, the head holds up while front and rear slides rough and finish face "G." This provides complete concentricity for all surfaces and gives excellent finishes free of tool interference.

Through the speed and economy of operation provided by the Simplimatic Automatic Lathe, floor-to-floor time on this job is only 3.4 minutes. Fourteen pieces are produced per hour, with 80% efficiency.

Three diameters are bored simultaneously in awkward workpieces by combining careful tooling with the versatile Simplimatic.

AT THE SHOW:

SIMPLIMATICS—50 h.p. machine on bevel gear blanks. Many new machine features include greater spindle speeds and automatic lubrication to the slides.

BALANCER HAS WELDING UNIT FOR ON-THE-SPOT CORRECTIONS

Correction equipment—either by addition of weight such as operator indicates here, or by weight removal, can be incorporated by any Gisholt Balancing Machine. New Type S catalog, Form #1165, gives complete details.

High Production Setup for Balancing Automotive Flywheels

You know the speed, efficiency and accuracy of manufacturing operations demanded by the automotive industry. Here's how vital balancing of automotive flywheels measures up to these requirements. This Gisholt 1SV1 Static Balancer measures, corrects and inspects these flywheels at a rate of 36 seconds per part.

It's a simple operation. As the flywheel is rotated, the Amount Meter tells the operator exactly how many correction lugs are needed. The strobe lamp, flashing on the numbered dial below the part, indicates where they are to go.

Welding equipment, mounted right on the machine, permits correcting the parts for balance in a single handling. The operator places the correction lug against the upper electrode of the welding gun where it is held magnetically until applied at the indicated angle. Then, a quick check to assure the part is within the prescribed tolerance—and the operation is completed.

Maximum efficiency and accuracy are attained by combining measurement, correction and inspection for balance in a single, fast operation.

AT THE SHOW:

BALANCERS—See actual production runs and demonstrations. Bench, vertical and large-capacity machines in use on static and dynamic balancing jobs.

No. 7-855
640

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Wherever you look AT THE MACHINE TOOL SHOW YOU'LL FIND

BLISS
E. W. Bliss Company
BOOTH #1414

BRYANT
Bryant Chucking Grinder Company — BOOTH #1015

CMC CLEARING USI
Clearing Machine Corp.
BOOTH #716

CLEVELAND
The Cleveland Automatic Machine Co. — BOOTH #412

CONSOLIDATED MACHINE TOOLS
Consolidated Machine Tool Co. — BOOTH #217

EDLUND
Edlund Machine Co.
BOOTH #115

famco
Famco Machine Company
BOOTH #507

FEDERAL PRESS
Federal Press Company
BOOTH #801

FOSDICK
The Fosdick Machine Tool Co.
BOOTH #1402

FOX
Fox Engineering Company
BOOTH #419

GALLMEYER & LIVINGSTON
Gallmeyer & Livingston Company — BOOTH #906

GREAVES
Greaves Machine Tool Co.
BOOTH #721

speeds installation of any machinery protects accuracy of precision machines

These machine tool builders cut set-up time at the Machine Tool Show from hours to minutes with BARRYMOUNT® Leveling Isolators. No drilling floors, no setting lag bolts, no shimming — they just set their machines on the Barry mounts, adjusted the leveling screws, and the normally tedious, costly job was done.

This is not just a show trick — it's a standard efficiency procedure for new installations and re-installations in large and small plants all over the country. And, *at the show or in your plant,* the isolation built into Barry mounts protects precision machines against vibration from nearby heavy equipment.

Visit us at Booth 153, Production Engineering Show, and a Barry engineer will show you how *you* can simplify installation, protect machine accuracy, prolong machine life, and cut maintenance costs with Barry Machine Mounts.

BARRY CONTROLS
INCORPORATED
703 PLEASANT STREET WATERTOWN 72, MASS.
SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES

JOHNSON
Johnston Machine & Press Corp.— BOOTH #411

KINGSBURY
Kingsbury Machine Tool Corp.
BOOTH #915

PRECISION PRODUCTION THROUGH MICROHONING MICRO MATIC
Micromatic Hone Corporation
BOOTH #1211

MOLINE
Moline Tool Company
BOOTH #1304

Monarch TURNING MACHINES
The Monarch Machine Tool Co.
BOOTH #920

THE MOTCH & MERRYWEATHER MACHINERY CO
The Motch & Merryweather Machinery Co.—BOOTH #606

Onsrud®
Onsrud Machine Works Inc.
BOOTH #812

RACINE
Racine Hydraulics & Machinery Inc.
BOOTH #102

SHEFFIELD
The Sheffield Corporation
BOOTH #1305

Van Norman
Van Norman Company
BOOTH #905

WIEDEMANN
Wiedemann Machine Co.
BOOTH #1420

STANDARD OIL COMPANY
(Indiana)

Tool Room Superintendent Max Chase (left) and Production Engineer Peter Van Dyke (right) with Standard lubrication specialist R. T. Cleland inspect frame of extruded aluminum. Bob Cleland, a graduate of Michigan State with a B.S. in Mechanical Engineering and of Standard's Sales Engineering School, has the background to provide customers with competent technical service on their lubrication problems. This training and experience, customers have found, pay off *for them.*

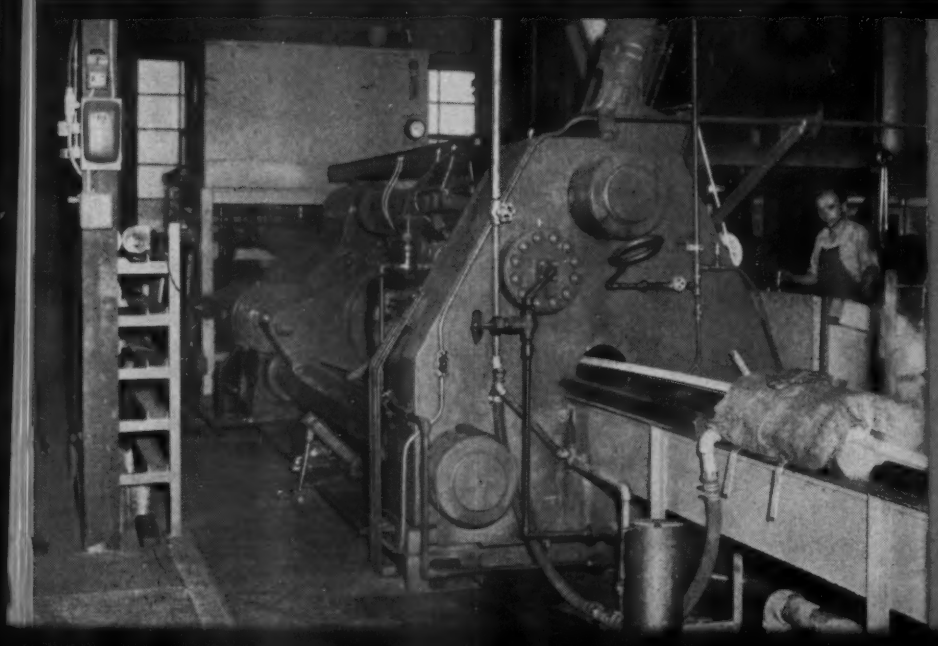
STANOIL *Industrial Oil does heavy chores for Light Metals Corporation*

Three years ago Light Metals Corporation, Grand Rapids, put their 1,250 ton Hydropress into operation. The initial fill for the hydraulic system was STANOIL Industrial Oil. The press has operated continuously since its start up. There is no evidence of deposits or varnish anywhere in the hydraulic system. Light Metals Corporation looks forward to many more years of such trouble-free operation.

Why was STANOIL ordered by Light Metals for their Hydropress? The answer is found in the service STANOIL has given in other equipment. Back in 1948 when a Watson-Stillman extrusion press went into operation for Light Metals, STANOIL was chosen as the hydraulic oil. As with the Hydropress, STANOIL has a perfect performance record. The Watson-Stillman press has operated seven years without a shutdown because of hydraulic fluid failure.

This kind of service from a hydraulic oil means Light Metals Corporation can turn out extruded aluminum shapes for the aircraft, automotive and major appliance industries with high performance and low maintenance factors that mean bigger profits. Reason enough for relying on STANOIL.

STANOIL Industrial Oil can perform for you just as it is doing for Light Metals Corporation. In the Midwest a lubrication specialist from your nearby Standard Oil office will explain how. Call him. Or contact, Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.



Light Metals Corporation uses this 1,250 ton Hydropress for extrusion of aluminum shapes for aircraft, automotive and major appliance industries. Press operates at 2,840 psi in the hydraulic system. Hydraulic medium is STANOIL.

This is a fast

Every hour, this Newton Vertical Rotary roughs and finish mills the tops of 600 aluminum pistons at 85% efficiency.

The machine automatically clamps, unclamps and ejects the finished pistons onto a conveyor. All the operator does is load!

A Newton Vertical Rotary is more than a machine tool—it is a method—the fastest known method of milling the flat surfaces of repetitive pieces!

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED MACHINE TOOL

A DIVISION OF FARREL-

one!

For aluminum milling, Newton Vertical Rotaries have high speed Vee belt drives and feeds up to 100 inches per minute.

COMPANY, ROCHESTER 10, N. Y.

FJB

BIRMINGHAM CO., INC.

Manufacturing data and costs—**ALUMINUM**

MACHINE: Browne & Sharpe, Model OG (Chain Drive)
OPERATING DATA: (this job)

Turning:	Spindle Speed	4230 rpm (forward)
	Surface Feet	692 per minute
Threading:	Spindle Speed	1365 rpm (forward)
	Surface Feet	200 per minute

OPERATIONS: Feed - clear - form & face - center - index - drill - index - combination flat bottom drill & chamfer - index - die on - cutoff - pickup & slot

CYCLE TIME: 5⅔ seconds **PARTS PER HOUR:** 635
EFFICIENCY: 80%
STOCK: ⅝" round, 2011—T3 (11ST-3) Aluminum

Weight per foot	.3748 pounds
Stock weight per 1,000 pcs.	15.6 pounds
Cost per pound (156 lbs.)	$0.701

TOOLING COST: $18.40 (same as for brass)

TOTAL COST: SET UP		$ 1.90
LABOR, INSPECTION, OVERHEAD, ETC.		15.00
MATERIAL: Stock 15.6# @ $.701/#	$11.04	
*Less scrap (60%)—9.36# @ 13¢/#	1.22	
NET COST	$ 9.82	9.82
TOTAL COST . per 1,000 in lots of 10,000 .		$26.72

*Typical Chicago Area scrap prices on 5-9-55.

Manufacturing data and costs—**BRASS**

MACHINE: Browne & Sharpe, Model OG (Chain Drive)
OPERATING DATA: (this job)

Turning:	Spindle Speed	4230 rpm (forward)
	Surface Feet	692 per minute
Threading:	Spindle Speed	1365 rpm (forward)
	Surface Feet	200 per minute

OPERATIONS: Feed - clear - form & face - center - index - drill - index - combination flat bottom drill & chamfer - index - die on - cutoff - pickup & slot

CYCLE TIME: 5⅔ seconds **PARTS PER HOUR:** 635
EFFICIENCY: 80%
STOCK: ⅝" round, free machining yellow brass

Weight per foot	1.133 pounds
Stock weight per 1,000 pcs.	46.8 pounds
Cost per pound (468 lbs.)	$0.5022

TOOLING COST: $18.40 (same as for aluminum)

TOTAL COST: SET UP		$ 1.90
LABOR, INSPECTION, OVERHEAD, ETC.		15.00
MATERIAL: Stock 46.8# @ $.5022/#	$23.50	
*Less scrap (60%) 28.1# @ 22¢/#	6.18	
NEW MATERIAL COST	$17.32	17.32
TOTAL COST . per 1,000 in lots of 10,000 .		$34.22

*Typical Chicago Area scrap prices on 5-9-55.

COST OF PART PER 1,000 IN LOTS OF 10,000	**IN BRASS**	**$34.22**
	IN ALUMINUM	**26.72**
	SAVING PER 1,000	**$ 7.50**
	21.9% SAVED ON THIS ONE PART!	

FOR BIG SAVINGS LIKE THESE...

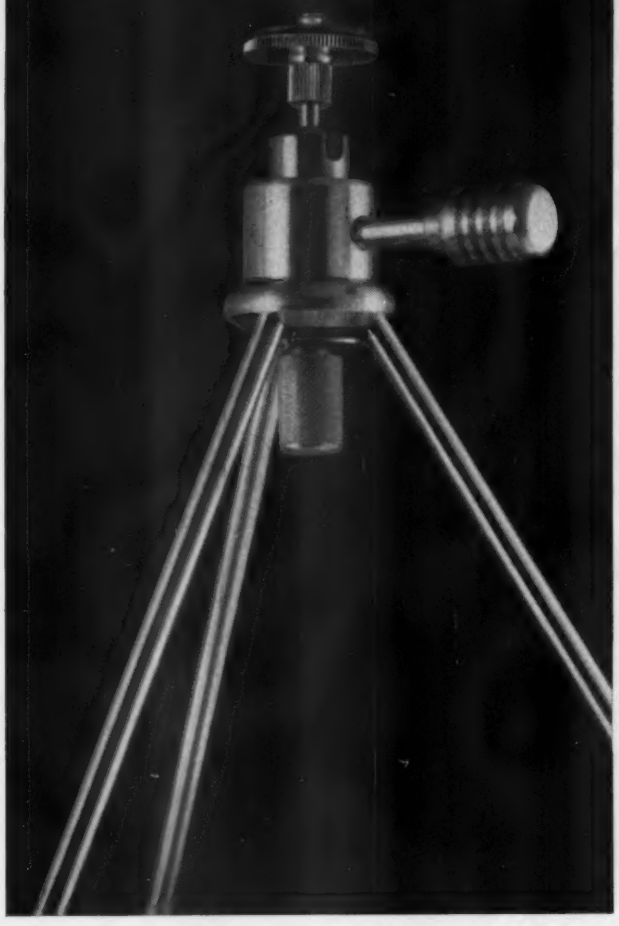
PROGRESSIVE screw machine shops all over the country have found that they can quote *below* competition—and often offer better parts—when they recommend that the parts be machined from Kaiser Aluminum stock.

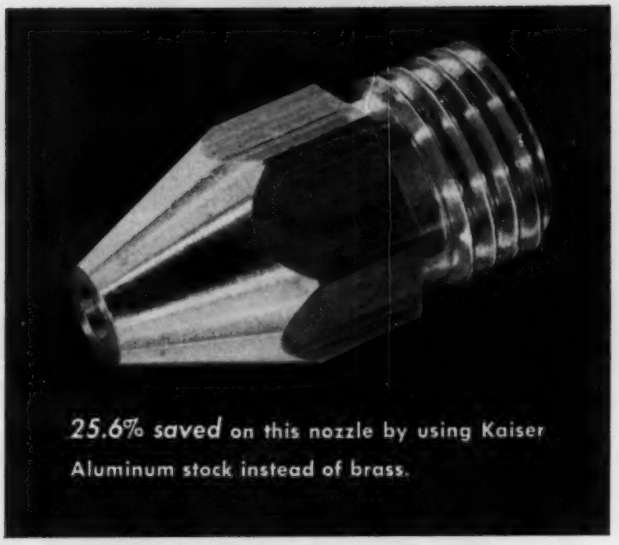
You get *three times* as many parts from a pound of Kaiser Aluminum stock as from a pound of brass or steel. Thus, each part can cost far less!

In addition, Kaiser Aluminum stock often permits other important economies: It eliminates expensive plating. It extends tool life. It reduces cleaning costs, because lightweight aluminum chips easily "float" from cavities. And its light weight greatly reduces shipping charges and cuts the cost of material and process handling.

For more information or assistance, look for our local number in the classified telephone directory under the heading "Aluminum" or contact one of our many distributors. Kaiser Aluminum & Chemical Sales, Inc. *General Sales Office,* Palmolive Bldg., Chicago 11, Illinois; *Executive Office,* Kaiser Bldg., Oakland 12, California.

34.1% saved on six parts of this tripod by using Kaiser Aluminum stock instead of brass.
18.5% saved when used instead of steel.





25.6% saved on this nozzle by using Kaiser Aluminum stock instead of brass.

35% saved on this swivel by using Kaiser Aluminum stock instead of steel.

THINK OF *Kaiser Aluminum*

Here's how easy it is to machine aluminum!

1. Cutting Tools. Like any metal, aluminum machines best at certain tool angles. The same tool materials can be used, though some tools must be ground to new angles. Your Kaiser Aluminum engineer or distributor can recommend machining practices proved best by operators experienced in aluminum.

2. Turning Speeds. On any existing screw machine, you can work Kaiser Aluminum stock up to the maximum efficient speed of the machine.

3. Chips. Aluminum alloys commonly used in screw machine operations form chips that curl and break satisfactorily. Alloy 2011 (11S) breaks into small chips similar to brass. With other alloys, chip breaking grooves ground into the tool assist in producing chips that are easily handled.

4. Thermal Expansion. Aluminum has its own rate of thermal expansion as do all metals. Experience quickly indicates how to compensate for this expansion. Recommended coolants are employed to assist in controlling this factor.

TECHNICAL EDITOR,
Kaiser Aluminum & Chemical Sales, Inc.
228 North LaSalle Street,
Chicago 1, Illinois.

Please send, without obligation, my copy of "Machining Kaiser Aluminum with Automatic Screw Machines," which contains valuable technical data and tooling information.

NAME_____

COMPANY_____

ADDRESS_____

CITY, STATE_____

facts

you should know about BATH gage production

Bath Reversible Thread and Reversible Cylindrical Plug Gages

- Bath Gage manufacture is based on quality
- Bath Gage engineering features experience
- Bath Gage personnel is highly skilled
- Bath Gage equipment is thoroughly modern
- Bath Gage production methods are progressive

Bath products have always been manufactured on an established policy of high quality. The basic desire to produce gages that are primarily an accurate standard of measure, requires experienced engineering, skilled craftsmen, modern equipment and progressive methods — plus a determination to build a reputation in the industry for gages that combine precision and long wear life.

This policy has been carefully maintained and today, Bath gages have earned recognition along with Bath taps, for dependable performance . . . proof of the adage "just as the twig is bent, so the tree's inclined".

A request on your business letterhead will bring your copy of the new Bath Tap and Gage Catalog.

to be Safe... it pays to buy Bath Gages!

JOHN BATH & CO., Inc.

22 Grafton St., Worcester, Mass.

CYLINDRICAL PLUG AND RING GAGES • THREAD PLUG AND RING GAGES • THREAD MEASURING WIRES
MASTER SETTING DISCS • INTERNAL MICROMETERS • GROUND THREAD TAPS

AUTOMATICS
that crack the break-even barrier
Through their advanced design, Warner & Swasey
Automatics open for you unexplored areas of profit
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SEE

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IN OPERATION

ON TYPICAL

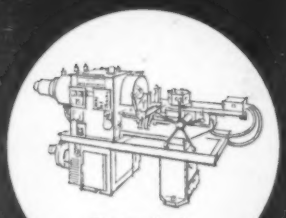
SHOP JOBS

THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATRE

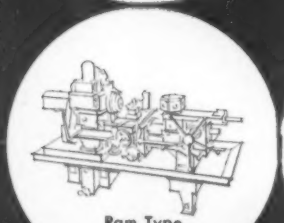
Most folks, we believe, go to the Machine Tool Show to take home ideas on how to do their own work more efficiently by seeing the latest machines and techniques available.

And we believe we can help you spend your time more profitably by showing you our machines turning the kind of jobs you encounter every day back home—the kind you're most interested in.

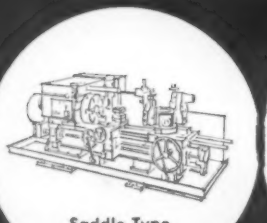
That's exactly what you'll see at the Warner & Swasey booth—the most modern machines available, utilizing the latest turning techniques, turning out typical shop jobs. You are cordially invited to visit us at 717.



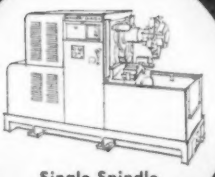
Electro-Cycle Turret Lathes



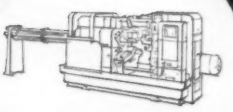
Ram Type Turret Lathes



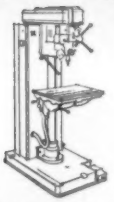
Saddle Type Turret Lathes



Single Spindle Automatics



Multiple Spindle Automatics

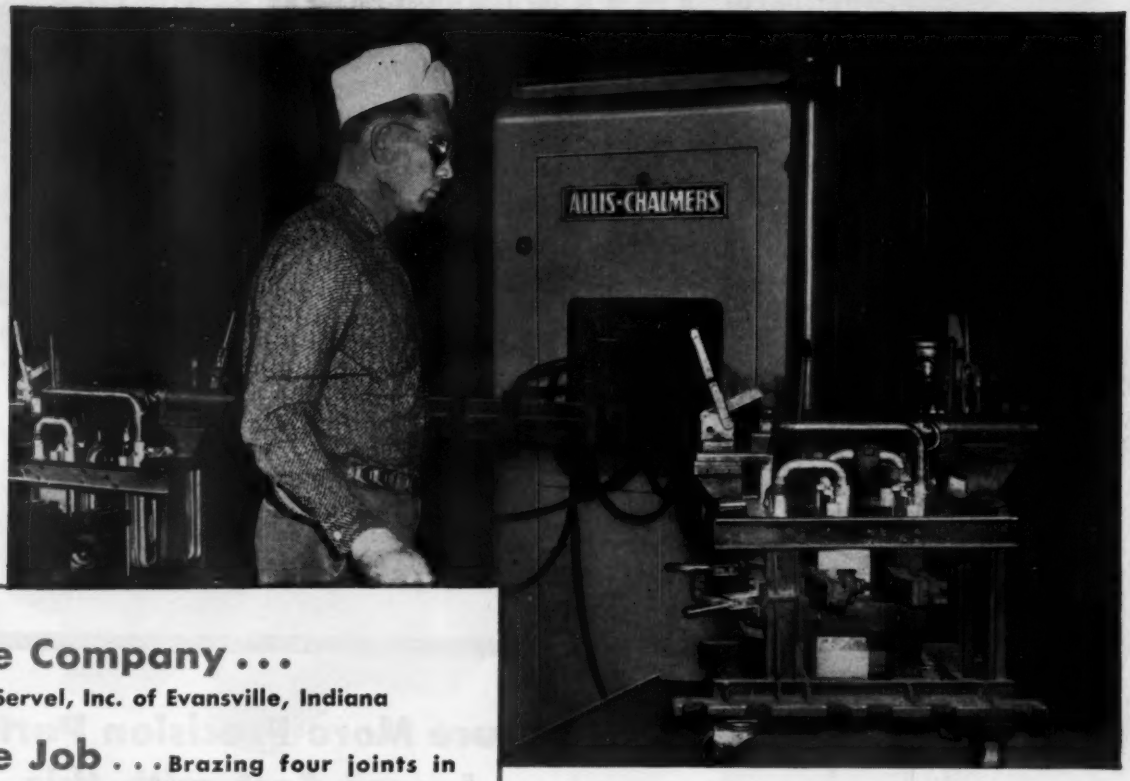


Precision Tapping Machines

75TH ANNIVERSARY YEAR
WARNER & SWASEY
Cleveland
PRECISION MACHINERY
1880 — 1955

NO MATTER WHICH WAY YOU TURN...
WARNER & SWASEY CUTS COSTS

How Servel, Inc.
Speeds Brazing Operations
with Allis-Chalmers Induction Heaters



The Company . . .

Servel, Inc. of Evansville, Indiana

The Job . . . Brazing four joints in evaporator assemblies.

By using Allis-Chalmers Induction Heaters, along with special work fixtures and preformed brazing rings, joints are heated to 2100 F in seconds; 120 joints or 40 evaporator assemblies can be completed in an hour.

Here's the setup . . .

An operator and four assemblers are stationed at each of the seven heaters in the plant. Assembly components are gathered from an overhead conveyor and placed in caster-equipped fixtures. Using a split coil arrangement, the operator alternately brazes two assemblies — one on the right table and one on the left table. Only one coil can be energized at a time. While the coil at the right is applying heat, the coil at the left is positioned. Shutoff is controlled by an automatic cycle timer.

What induction heaters can do for you . . .

Whether you're handling long production runs, small odd-lot jobs, or a mixture of both—here's a tool that affords plenty of profit opportunities. A mere change of the working coil allows you to braze, heat, harden, solder, or anneal. Easy adaptability to many types of setup holds production changeover time and cost to a minimum. And, though heating operation is fast, it provides close heat control.

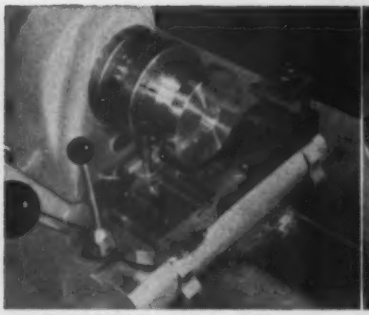
Interested in knowing more? Then contact your nearby A-C District Office or write—Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

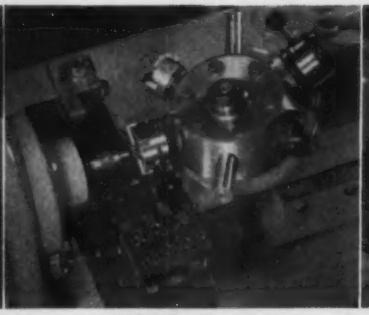
A-4725

HARDINGE
ELMIRA, N.Y.

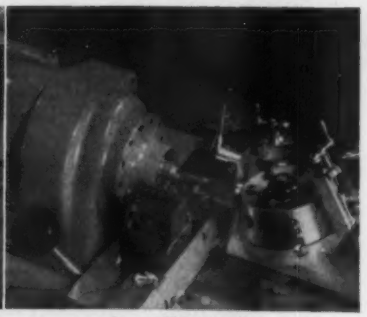
NEW Variable Speed Machine for PRODUCTION DEPARTMENTS



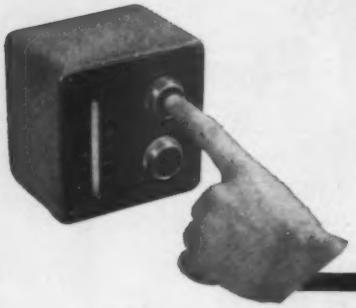
Large Work



Threading



Small Work



Simply Push a Button for Exact Spindle Speed

Produce More Precision Parts at Lower Cost with this NEW Second Operation Machine

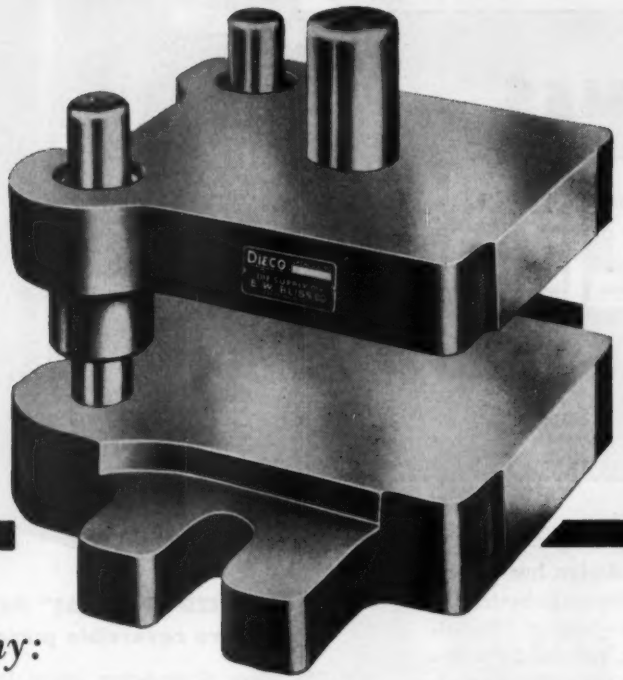
Send for Free illustrated Bulletin DSM59

HARDINGE BROTHERS, INC. ELMIRA, NEW YORK, U.S.A.

OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette St., New York 12, N. Y.

DIECO, *the midwest's favorite die set, is—*

RAPIDLY BECOMING A NATIONWIDE FAVORITE!



here's why:

- Hardened steel pins are rough and finish ground, then *super-finished.* Closer tolerances give more accurate guiding.
- High-tensile steel plates are first *stress-relieved*, then precision machined—perfectly parallel, they stay parallel under load.
- All parts electronically gaged for perfect fit.
- Choice of bronze-lined on hardened steel backing or hardened steel bushings—all with grease fittings. Precision ground and micro-honed to less than a "tenth" tolerance; can be arranged for pressure lubrication.
- Welded or screw shanks; any length guide pin.
- 1728 combinations in steel or semi-steel—interchangeable parts speed delivery.

An office near you offers fast delivery and competent counsel on die set needs—

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DIECO

Industry's most complete line of die sets and die makers supplies

DIE SETS • GUIDE PINS • BUSHINGS • SPRINGS • SOCKET HEAD SCREWS • 5001 ITEMS

another

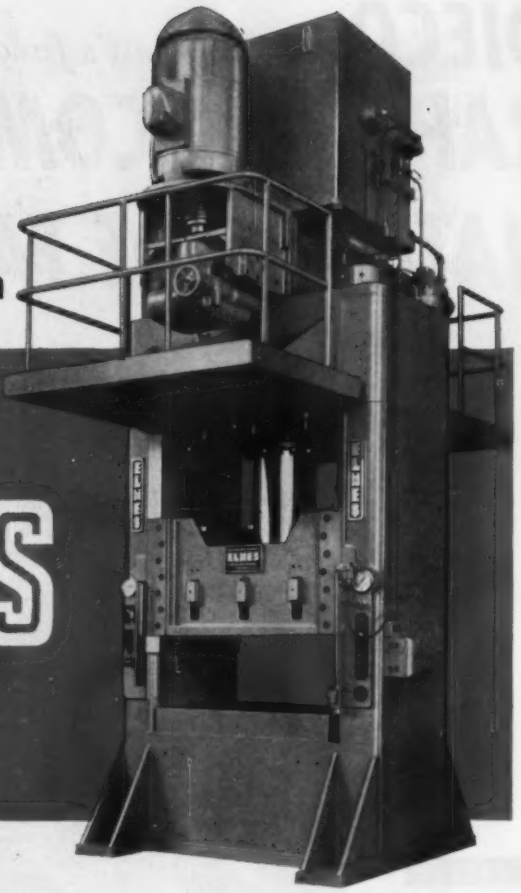
Outstanding Elmes Development

in Metalworking Press Design

the ELMES

PIPELESS

HYDRAULIC PRESS



THIS exclusive Elmes® Press design has put an end to high-pressure piping troubles. The main hydraulic circuit in these Elmes Presses *has no piping!* The advantages of this unique pipeless construction, proved by widespread use throughout industry over an extensive period, assure *a radical reduction in maintenance cost, with virtual elimination of downtime.*

In Elmes Pipeless Presses, all high-pressure hydraulic fluid is conducted through short, direct passages drilled in the structural parts. There are no high-pressure screwed joints to loosen, no oil dripping from loosened fittings, no breaking of welded joints. Press operation is smooth, quiet. Reversal of the ram is shockless. Vibration is greatly reduced. Turbulence and oil heating are minimized. Response to electrical controls is prompt and precise.

Any Elmes Metalworking Press, standard or special, can be equipped with pipeless construction—*and at no premium.* Find out now how your production will benefit from the matchless performance of Elmes Pipeless Hydraulic Presses. A proposal to suit your particular requirements, or further information, will be supplied on request. Contact your Elmes Distributor or write us direct.

HIGH-SPEED "PIPELESS" PRESS with two reversible pumps

450-Ton Elmes Single-Action Metal Drawing & Forming Press, with many special features including the revolutionary Elmes Pipeless construction. This press employs two reversible pumps, providing the following operating speeds per minute: advance —550″, press—126″, return—550″.

Be sure to see the Elmes **PIPELESS** *Press in operation at the Show*

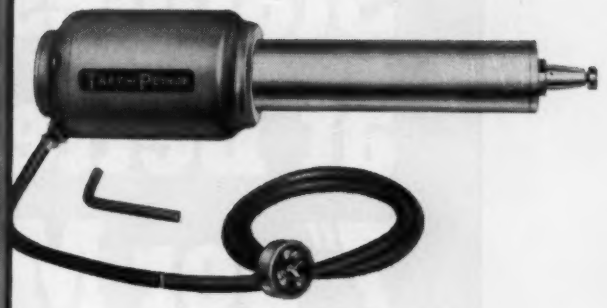
ELMES

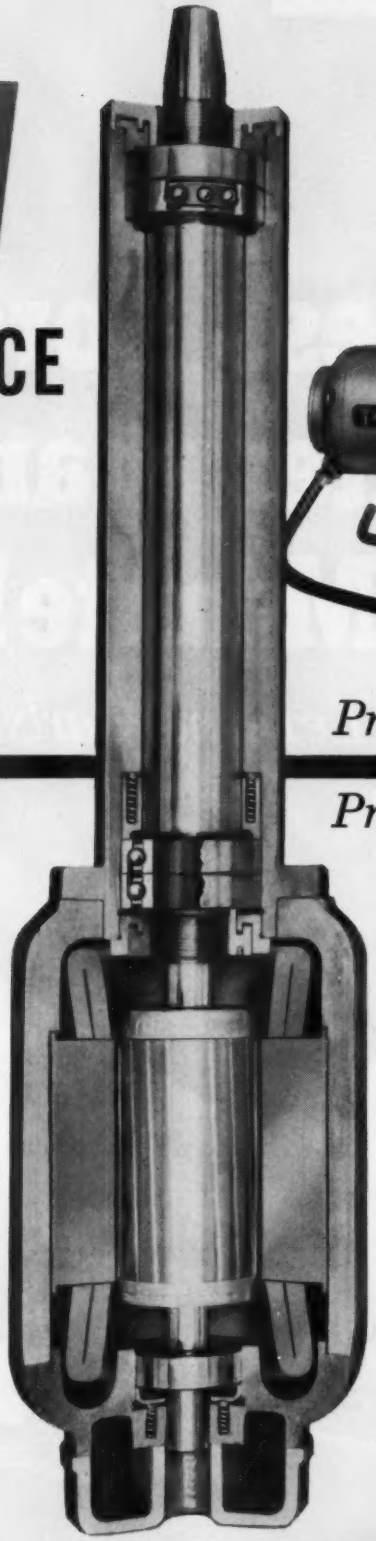
AMERICAN STEEL FOUNDRIES • ELMES ENGINEERING DIVISION
1161 Tennessee Avenue...Cincinnati 29, Ohio

HYDRAULIC PRESSES & EQUIPMENT

METAL-WORKING PRESSES • PLASTICS MOLDING PRESSES • PUMPS • ACCUMULATORS

NEW TAFT-PEIRCE GRINDING SPINDLE





Provides Ultimate in Precision and Finish

Here's a new model Grinding Spindle that permits the very finest micro-inch finishes. Ideal for surface grinders and many other machine tools, this new T-P Grinding Spindle offers a long list of quality features.

Precision balanced on its one bearing

Low operating temperature

Rugged internal construction eliminates deflection and vibration

Springs assure constant uniform preload — no maintenance required

Labyrinth sealing system eliminates drag or wear

Spindle shaft is hardened and completely finish-ground for alignment and balance

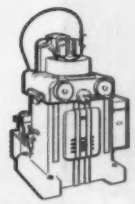
Simple holding means for mounting wheel thimbles

Built with the utmost care and precision for our own use, this spindle is now available as a standard product. Write for details.

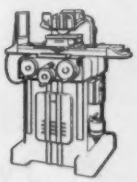
See them at the show — Booth 811

SPECIFICATIONS

Motor — 1 h.p.
Speed — 3600 r.p.m.
Quill — 3″ diameter
Nose Taper — 3″ per foot
Length — 23½″ overall
Lifetime lubrication

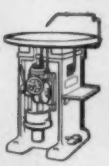


Rotary Surface Grinders



Precision Surface Grinders

Lapping Machines



Back Spot Facing Machines

T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY · WOONSOCKET, RHODE ISLAND

At the Show...

See Stainless Bored at Better than 7"per Minute!

on the New LeBlond-Carlstedt Rapid Borer

With the new LeBlond-Carlstedt Rapid Borer, you can bore, trepan or counterbore holes *3 to 8 times faster than by the conventional D-bit method!* We'll prove this at the Machine Tool Show. You'll see a 1⅛" hole bored in solid Stainless 303 at better than 7" per minute. We'll bore 4140, C-1141 and 6150 even faster!

The Rapid Borer was developed expressly to accommodate revolutionary new tooling which cuts at very high speed with excellent accuracy and finish. Cutting oil is forced between the boring bar and hole wall forming a continuous bearing. It flushes back through a hole in the boring head and bar, carrying away the chips as it goes. Chip form is controlled both by tool angles and proper feed and speed combinations; thus tool faces are kept clean and chip passage clear. Cutter design produces balanced cutting pressures thereby controlling concentricity.

This new tooling requires a machine with the following characteristics, all of which are incorporated in the Rapid Borer's design:

High spindle horsepower

Ample rigidity throughout

Complete absence of vibration at all speeds

Infinitely-variable feeds (up to 38" per minute), independent of speeds, while running under load

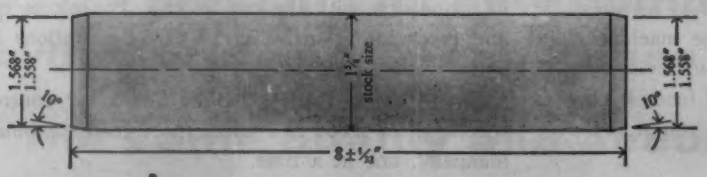
Final drive to spindle through belts

Large volume of cutting oil

Basically, the Rapid Borer is suited to work that is symmetrical for balance in rotation—round, square, octagonal, tapered or stepped. A wide variety of hole diameters and depths as well as work sizes can be accommodated.

Tell us about the holes you'd like to produce faster. Large holes or small. If the Rapid Borer can handle the job, we'll show you how to produce them faster than ever before.

Like to see your own materials bored at the show?



Just prepare sample bars of the materials you are now boring, or intend to bore. Make them according to the drawing here. Bring them to the Show and we'll bore them for you on the Rapid Borer.

See it at the show. No. 1313—dead center of the new exhibition hall.

...cut with confidence

The R.K.LeBlond Machine Tool Company

Cincinnati 8, Ohio

World's largest builder of a complete line of lathes for more than 68 years

LeBLOND of Cincinnati

new Carlton pre-selector

One of 3 different speed-feed controls for Carlton radial drills

The new Carlton-Leber speed-feed pre-selector system speeds up drilling by permitting operator to set speed and feed for the next operation while the machine is still under cut. With this productive new device, the time lost heretofore in setting speeds and feeds is now used for almost continuous drilling. Now you stop the spindle only for changing cutting tools.

Additional time is saved by instantaneous gear shifting made possible by mechanically oscillating the change gears which assures quiet gear mesh.

Programming—another Carlton-Leber system used in connection with the pre-selector. Pre-selects speeds and feeds for as many as 20 or 30 operations in an entire drilling program.

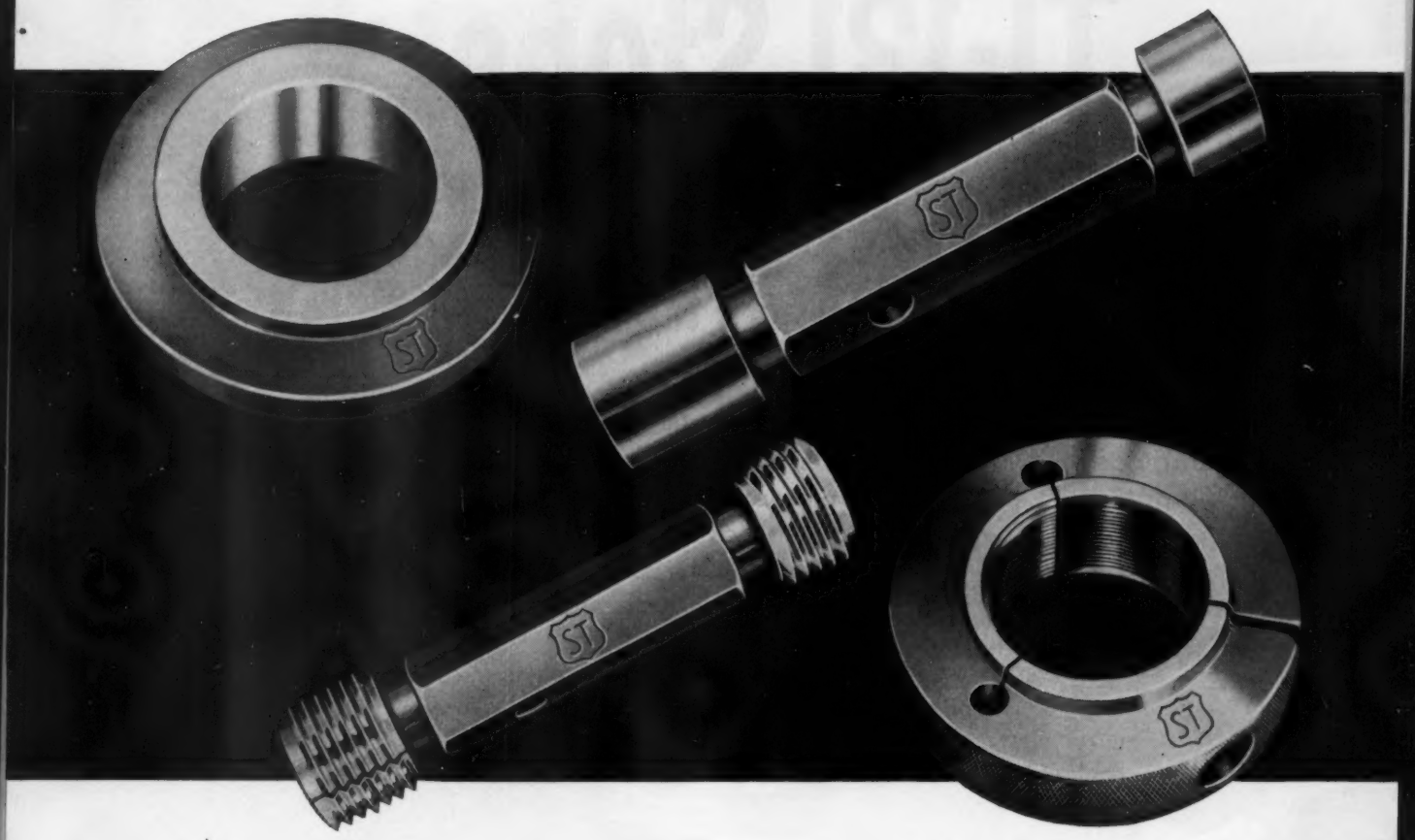
Manual Gear Shift: 2 shift levers for controlling speeds, 2 for feeds . . . select speed-feed combinations manually, one at a time.

Write for descriptive bulletin giving complete information. The Carlton Machine Tool Co., Cincinnati 25, Ohio, U.S.A.

See all 3 . . .
controls in action at the Machine Tool Show, International Amphitheatre, Chicago, September 6-17. Be sure to visit Carlton booth 919.

Carlton
horizontal and radial drills

CYLINDRICAL AND THREAD GAGES



STANDARD TOOL ... *serving Industry since 1881*

presents its new complete line of cylindrical and thread gages – plugs and rings

The same quality and accuracy that is built into Standard's complete line of metal cutting tools

Now available through Standard Tool Co.'s Distributors

STANDARD TOOL CO.

3950 CHESTER AVENUE CLEVELAND 14, OHIO

FACTORY BRANCHES IN: NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Carbide-Tipped Tools · Gages*

Here's great news from Johnson's Wax

TL-131 Stops Foul Coolant Odors

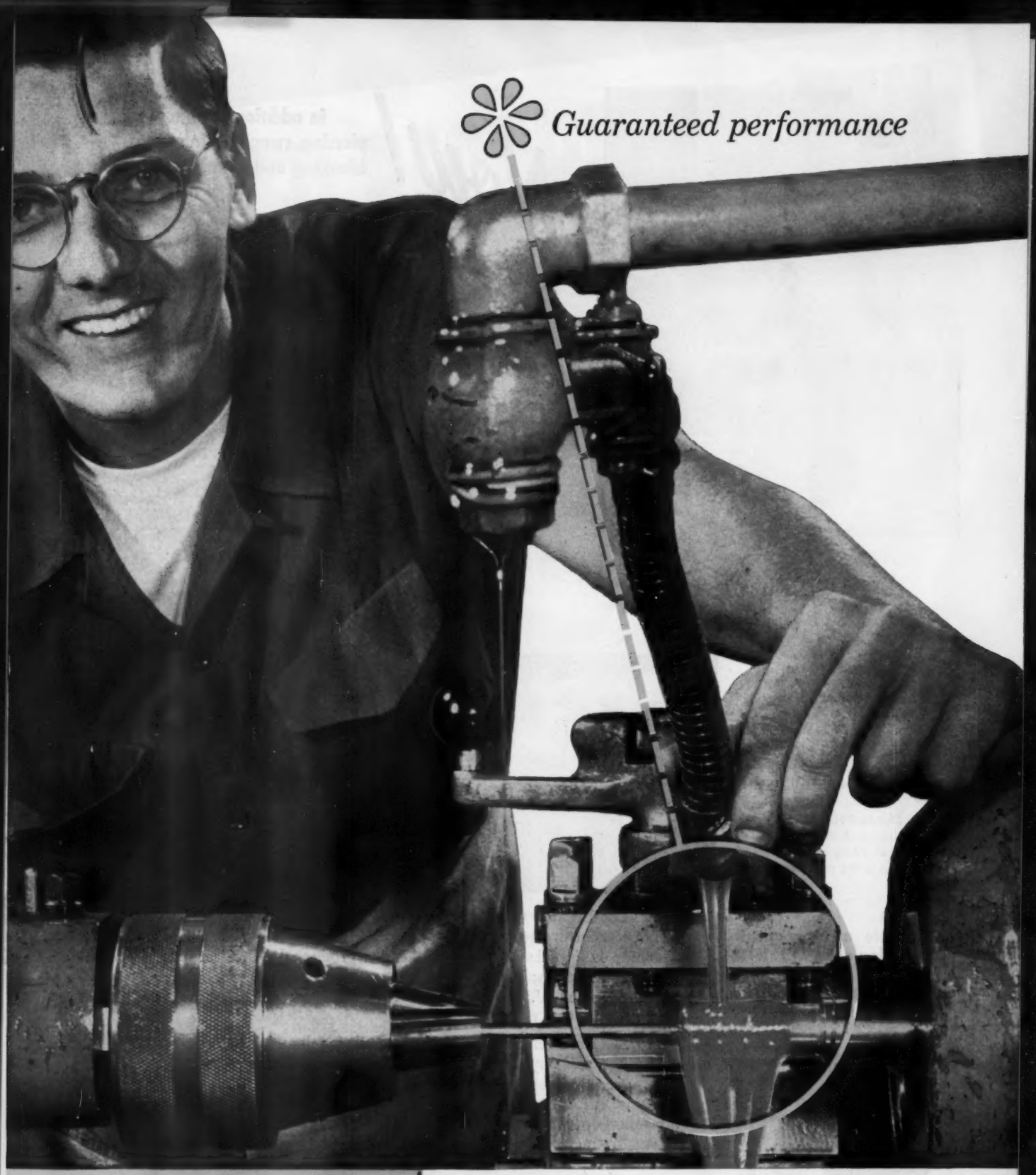
Johnson's Wax research scores an all-important, cost-saving *first* with its top-performing coolant, TL-131. Johnson's now offers with TL-131 a two-month guarantee*... *no foul odors from the coolant in your machines.* Think of the savings, of the increased productivity of men and machines!

Your money back if **TL-131** causes coolant odors

There's hot, humid weather ahead, bringing with it the headaches of coolants that turn sour and create offensive odors. Combating coolant odors is time-consuming and costly . . . changing coolants every week or two . . . using irritating bactericides.

Now, Johnson's Wax announces that TL-131 is guaranteed to solve the problem of foul coolant odors. Simply clean your coolant system thoroughly, charge with fresh, clean TL-131 (economically diluted 40 to 1 with water), and we *guarantee* TL-131 will work efficiently for two full months without causing foul odors.

In addition, TL-131 consistently outperforms ordinary coolants to provide increased tool life and greater production. Remember, TL-131 is the coolant that reduces work heat by 400°F. See your local distributor for an in-the-shop test. Mail the coupon for full information.



Mail this coupon today for FREE informative booklet on how to end foul coolant odors with TL-131.

A PRODUCT OF JOHNSON'S WAX

S. C. JOHNSON & SON, INC.
Industrial Products Division, Dept. AM-8
Racine, Wisconsin

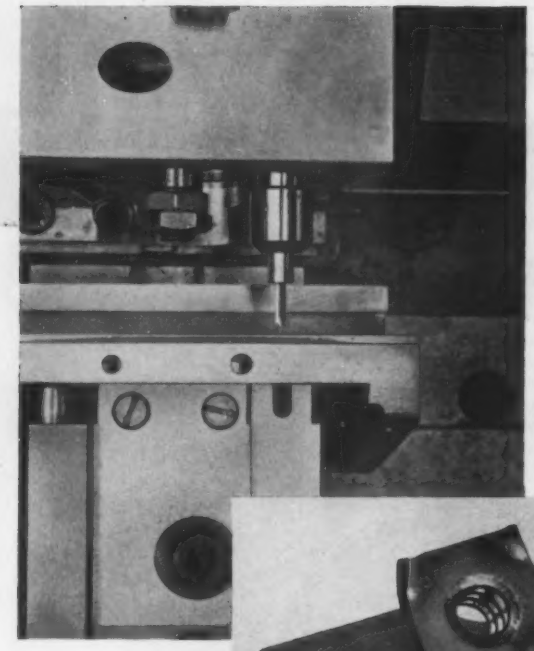
Please send me your informative booklet on TL-131 Coolant.

Name_____

Firm Name_____

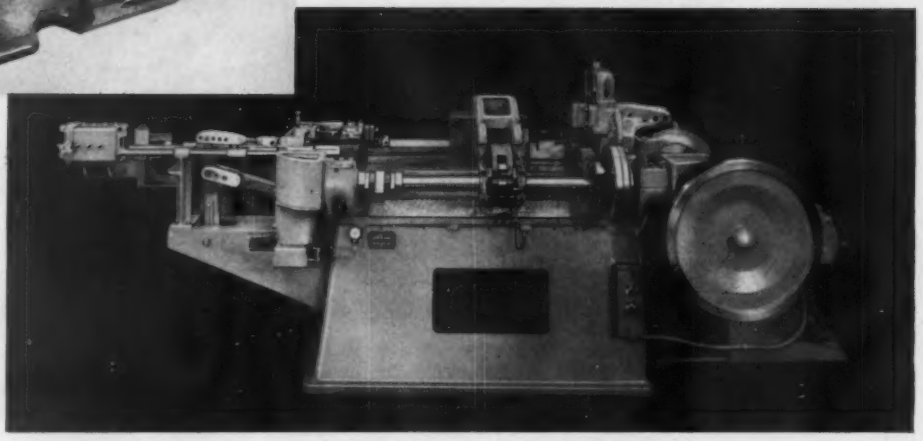
Address_____

City_____ Zone____ State_____



Now! In addition to trimming, piercing, swaging, embossing, blanking and forming . . . .

TAPPING on the U. S. MULTI-SLIDE®



Top: Close-up top view looking down into tapping position on the U. S. Multi-Slide.

Above: Allen-Bradley Coil Terminal produced complete on No. 33 U. S. Multi-Slide, including tapping a 6-32 hole. Shown about three times actual size.

Right: Standard No. 33 U. S. Multi-Slide Machine which is used (with the addition of a tapping head) for the production of the part shown above.

See this equipment in operation at BOOTH 215, MACHINE TOOL SHOW, International Amphitheatre, Chicago, Ill., September 6-17, 1955.

The Allen-Bradley Company of Milwaukee, Wisconsin, manufacturers of quality motor controls, will install in their plant a No. 33 U. S. Multi-Slide Machine equipped with a tapping head to produce the Coil Terminal shown above *complete including the tapping of a 6-32 hole.* The incorporation of tapping in the U. S. Multi-Slide eliminates the need for a secondary operation on this part.

The U. S. Multi-Slide is designed and built for the automatic production of stampings, and any or all of the following operations may be incorporated to produce complete parts at each stroke of the machine: trimming, piercing, swaging, embossing, blanking and forming. Now the possibility of including a tapping operation further increases the versatility of the Multi-Slide, and offers to the user increased potential for cost reduction by eliminating secondary operations and handlings.

Bulletin No. 15-A contains complete specifications. Write for a copy.

U.S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides — U. S. Multi-Millers
U S. Automatic Press Room Equipment — U. S. Die Sets and Accessories

SPEED RECORD BROKEN

2,000 Horse Power Motor Shafts

ROUGH and FINISHED in

2¼ hrs.

Former Time 9 hours

Fairbanks, Morse & Co., Beloit, Wisconsin, is getting this amazing production day after day on its *20 inch "AMERICAN" All-hydraulic Duplicating Lathe.*

These shafts are made from 7½" diameter by 84" long hot rolled stock weighing 1059 pounds. A 30 horse power roughing cut and 15 to 20 horse power finishing cut completes the operation.

Note particularly that a finish turned motor shaft is used for a template, showing the rugged stability of "AMERICAN" Template Supports.

The quality of Fairbanks-Morse's products are universally recognized. We are proud indeed that so many "AMERICAN" Lathes and Radial Drills contribute to them. "AMERICAN" Hydraulic Duplicating Lathes hold many production records for work of this nature. Let us show you what they will do on your work.

Send for Bulletin No. 35.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

PREVIEW ITS SPEED, ACCURACY AND VERSATILITY AT THE SHOW!

CAST IRON END PLATES

30 pieces (60 surfaces) per hour; ⅛" stock removed each side; limits ± .002"

ADJUSTING SCREW WASHERS

Low carbon steel; 200 pieces (200 surfaces) per hour; .025" stock removed; limits ± .001"

HOT ROLLED STEEL CAMS

225 pieces (450 surfaces) per hour; 1/32" stock removed each side; limits ± .001"

NOW! BLANCHARD PRESENTS ANOTHER GREAT NEW GRINDER *with Automatic Cycle Control*

When you're at the show, watch this great new Blanchard Surface Grinder perform a variety of jobs with speed, ease and accuracy.

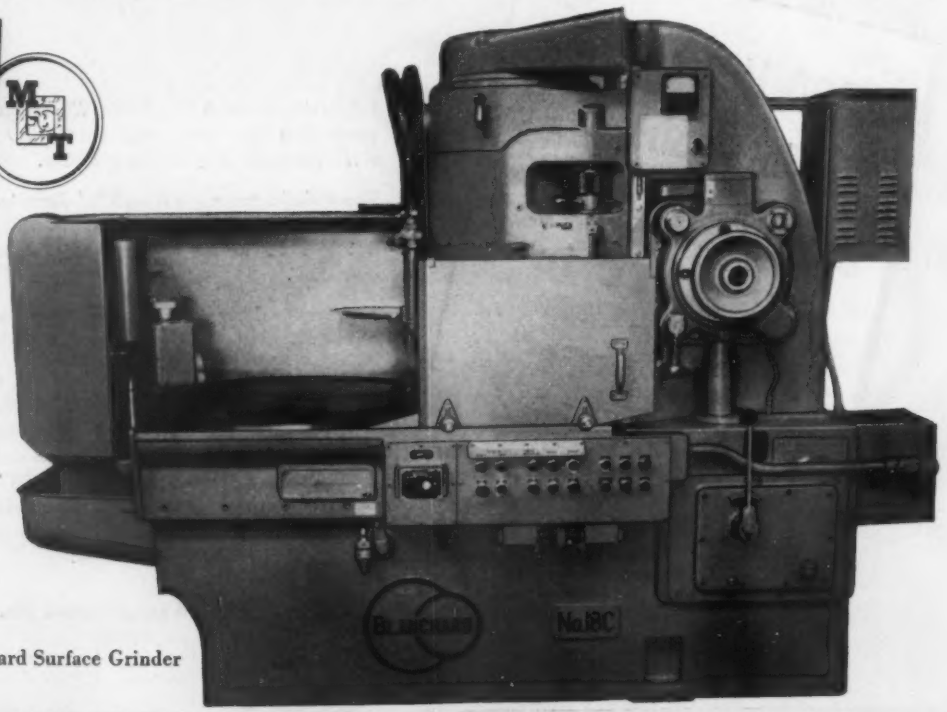
One operator can easily operate two of these No. 18-C grinders under balanced conditions. By using the automatic cycle, he can unload, clean and reload one grinder while the other is grinding.

Here's what the automatic cycle does: moves chuck (30" or 36" dia.) to grinding position and starts it rotating; starts wheel rotation and coolant pump; provides rapid wheel approach to work; engages power down-feed at preset rate; changes to fine feed just before finished size is reached; stops feed when work is to size – "sparks" out; raises wheel head; stops wheel, coolant pump and chuck; moves chuck to loading position – demagnetizes chuck.

This new Blanchard also features: push button selection of manual or cycle operation; size control; simplified feed and head traverse controls; adjustable dwell timer.

THE MACHINE TOOL SHOW
CHICAGO, ILL.

BOOTH 406



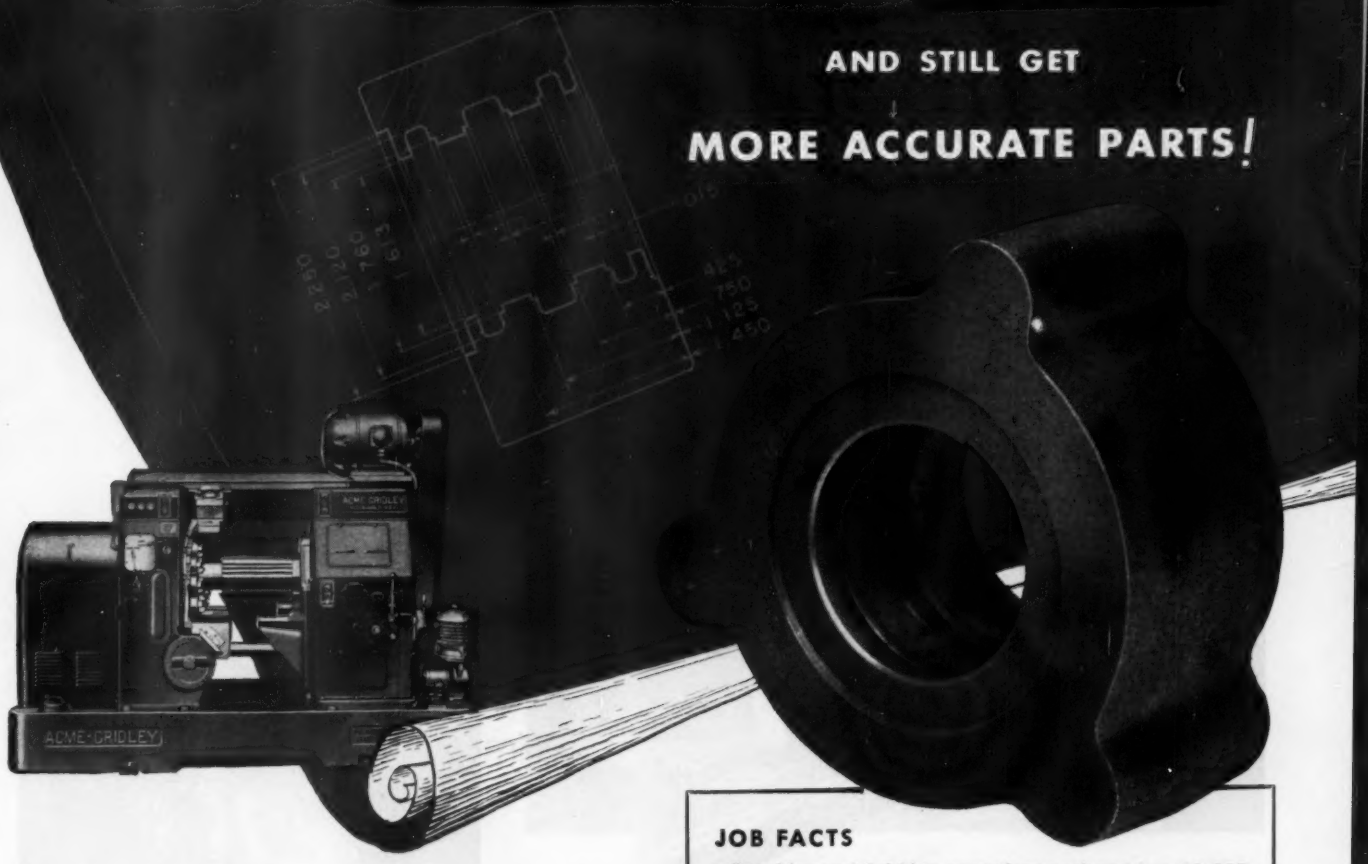
No. 18-C Blanchard Surface Grinder

THE BLANCHARD MACHINE COMPANY 64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

HOW TO COMPLETE THE JOB *Faster...*

AND STILL GET

MORE ACCURATE PARTS!



JOB FACTS

- **Roughing and finishing operations performed on this SAE 120-121 Cast Iron Housing include multiple recessing shown in sketch. The three grooves were rough recessed in one station and finished recessed together with front and rear counterbore in another position.**
- **Three rough boring passes were finish-reamed with accelerated reaming attachment in one pass.**
- **Carbide tooling used throughout.**

When you tool up jobs this way on an ACME-GRIDLEY MULTIPLE SPINDLE CHUCKING AUTOMATIC, you often *complete* the parts in one setup—and they are more accurate and uniform because rehandling and rechucking for second operation work is eliminated.

And the corollary to this is that man hours are released for other work—and space formerly needed for second operation work is saved.

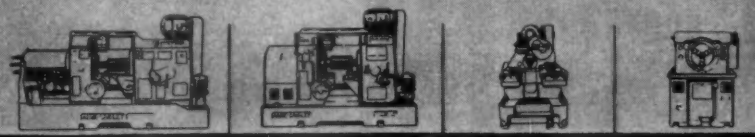
On this cast iron housing, all 17 operations were performed simultaneously, with a *single completely carbide-tooled setup*—on an Acme-Gridley 8-inch, 8-spindle chucker. And because the work on all spindles is always done within the time required for the longest single cut, the floor-to-floor time on this job was at the rate of 61 *completed* pieces per hour.

This is where multiple spindle *planning* pays off.

And this is where the vast experience of National Acme tooling engineers (they have helped plan the cost-reduction of more than 300,000 jobs) wins and holds preference for Acme-Gridley bar and chucking automatics—in hundreds of shops.

These engineers will give you sound advice; unbiased advice in both job setup and equipment—from the world's only manufacturer of a *complete line* of multiple spindle bar and chucking automatics and fully automatic turret lathes.

Send for Catalog CM-51 or ask for our recommendations



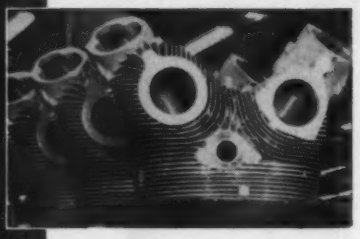
OUR JOB: to provide the *Right Machine* for **YOUR JOB**

Acme-Gridley 4, 6 and 8 Spindle Automatic Bar and Chucking Machines • Fully Automatic Turret Lathes (Bar and Chuck Type) • Hydraulic Thread Rolling Machines • Automatic Threading Tools • Switches • Solenoids • Contract Manufacturing.

THE NATIONAL ACME COMPANY

171 EAST 131st STREET • CLEVELAND 8, OHIO

Cincinnati Bickford MEETS ALL REQUIREMENTS AT Canadian Pratt & Whitney Aircraft Company LIMITED



Drilling, Core Drilling and Reaming Alloy Steel Cheek and Counterweights of Aircraft Engine Crankshafts. Reamed holes are held accurate within .0005". Second machine is boring and facing Inlet and Exhaust Ports on Cast Aluminum Cylinder Heads.

Six Cincinnati Bickford 9" column Super Service Radial Drills have given a fine performance and established a record for accuracy and reliability, and have met production problems at Canadian Pratt & Whitney Aircraft Co., Ltd. Modern Cincinnati Bickford features for convenient easy handling, power and speed have made these machines highly profitable. Investigate these money makers.

Write for Bulletin R 21C.

Drilling, Counterboring, Reaming and Tapping 1¾" Hole in Aluminum Crankcase Forging Section to a tolerance of ±.001".

Photos courtesy of Canadian Pratt & Whitney Aircraft Co., Ltd., Montreal, Canada.

THE MACHINE TOOL SHOW

BOOTH 901

80 YEARS OF SERVICE

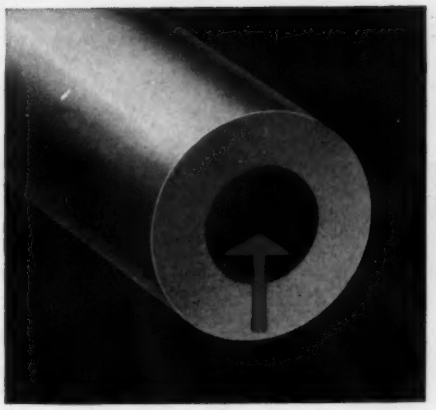
CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

a hole here wastes time . . .



a hole here saves time

Crucible Hollow Tool Steel Bars save time — and money too — whenever you need ring-shaped steel parts, or tools with a center hole. The tool steel is drilled through when you get it! You don't need to bore, drill, hole-saw, cut off or rough-face. That's why they cut your production time, increase machine capacity — and reduce scrap losses.

You can get these hollow bars in any of Crucible's famous quality tool steels, in almost any combination of OD and ID sizes. And you can get *immediate* delivery of five popular grades — KETOS oil-hardening; SANDERSON water-hardening; AIRDI 150 high carbon, high chromium; AIRKOOL air-hardening; and NU DIE V hot-work tool steels — from the Crucible warehouse near you.

Call your Crucible representative for the full story of how these steels can save time and money in your shop. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

Visit us at Booths 830-832 Production Engineering Show, September 6-16, Navy Pier, Chicago.

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

The man who needs a new machine tool and doesn't buy it is paying for it anyway...

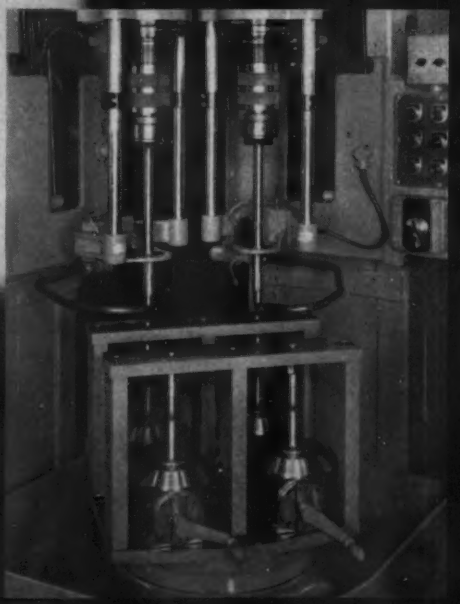
in scrap losses

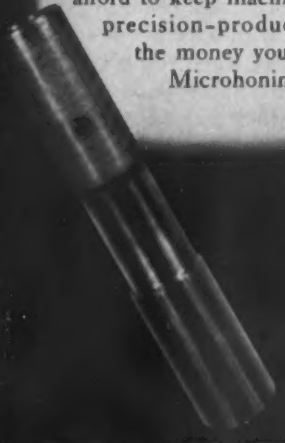
Age alone doesn't obsolete machines. There are other factors. Consider the closer tolerances of two- or three-tenths now being demanded on the production line. Many a machine tool installed only five years ago can't hold to these precision tolerances. Any attempt to do so results in high scrap losses.

Consider the design of the machine. Today there is less dependence on the skill of the operator. Less subjection to human inconsistency. The built-in controls on machines utilizing the latest processing techniques minimize the problem of rejected parts.

One process with which industry obtains precision-production is Microhoning. This low-velocity abrading technique, employing low speeds and removing stock over a wide area, produces parts to exact dimensional and geometric accuracy. Microhoning uses a self-aligning tool with self-sharpening abrasives. There are no chucks to wear out of alignment; no off-tolerance parts because of dull tools or abrasive wheels needing dressing.

Check your scrap losses. Then decide whether you can afford to keep machine tools that cannot produce to current precision-production standards. You may discover that the money your scrap is costing you would buy a new Microhoning machine.





PART:
Shaft, Convertor Reactor

PROBLEM:
Flame hardening caused shaft to bow, resulting in a high scrap rate.

SOLUTION:
Microhoning — removed from .004" to .008" stock from the diameter, generated a straight, round bore and eliminated scrapping of parts.

MICROHONING = STOCK REMOVAL + GEOMETRY + SIZE CONTROL + SURFACE FINISH

Visit Booth 1211 at the Show. See other examples of how Microhoning can reduce scrap losses.

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If your lubrication program calls for *many different* oils and greases, it's a safe bet your maintenance men are spending far too many man-hours in application.

Pure Oil has perfected a line of *multi-purpose lubricants* which reduces the number of lubricants to a money-saving *few*. This means faster application . . . fewer errors in application . . . reduced inventory . . . simplified inventory control . . . more efficient purchasing.

Find out how Pure's *multi-purpose* lubricants can cut costs in *your* plant. Reverse the charges to your nearest Pure Oil office today.

FREE BOOKLET tells you "How to Simplify and Save." Write The Pure Oil Company, 35 E. Wacker Drive, Chicago 1, Illinois. (Offer limited to Pure Oil's 24-state market area.)

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A NO IMPACT HOLDDOWN SYSTEM FOR SHEARS

The Lodge & Shipley "No Impact" holddown system means *no* mars, *no* dents, *no* holddown clatter . . . and you still get positive holding power for accurate cutting, unsurpassed by any shear!

With the new Lodge & Shipley holddown system eliminating impact *and* damage, you can now shear the softest, most highly polished metals without impact mar. This "soft touch with terrific holding power" is a Lodge & Shipley exclusive!

Also available, for standard shearing, is the proven Hydro-Hold holddown system which offers positive, fast acting operation!

ASK ABOUT IT at The Machine Tool Show—Lodge & Shipley Booth 502. Also, be sure to see the All-New Shear and Press Brake.

In Shears, Too . . . Your Lodge-ical Choice

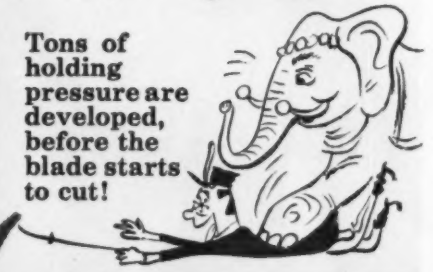
Lodge & Shipley

Hamilton Division
Hamilton 2, Ohio

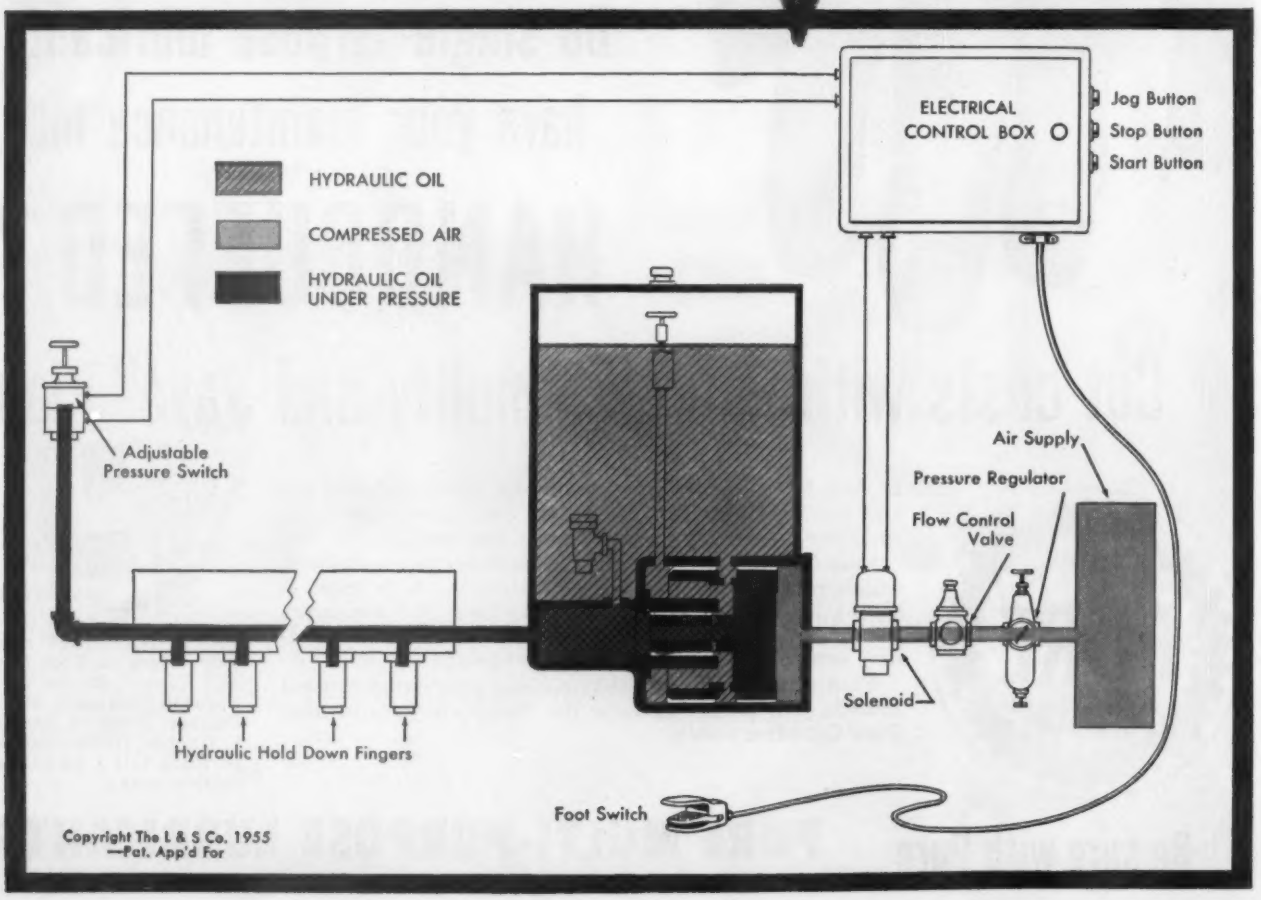
NOW . . . and exclusively from Lodge & Shipley . . . you can choose a shear with a holddown system perfectly suited to your shearing requirements.

"THE SOFT TOUCH WITH TERRIFIC HOLDING POWER"

There's no impact, no damage, no noise, when the holddown lightly touches, then . . .



Tons of holding pressure are developed, before the blade starts to cut!



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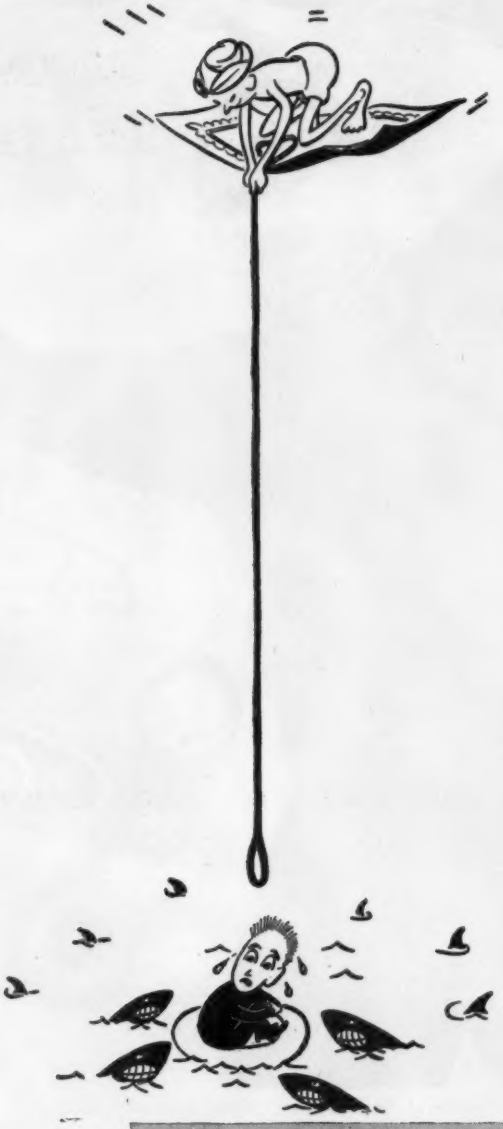
—Pat. App'd For



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FOR THE FINEST IN
CUTTING TOOLS AND GAGES

Made by THREADWELL, Greenfield, Mass.

Joseph H. Snyder, President of the Color Corporation of America, tells:

"How we set a record with the Thunderbird!"

"When news got out about the Thunderbird, Ford dealers scheduled a big preview at Palm Springs, California," relates Joe Snyder of Color Corporation of America.

"But as the date drew near, it became clear to Ford that the one Thunderbird then in existence—a hand-made model—would have to stay there in Detroit!

"The solution? Giant natural color prints—and Air Express.

"Films were rushed to the Color Corporation in Tampa, and we made Hi-Fidelity color prints *larger than the top of a desk*. These were back in Detroit in record time—and in Palm Springs the day after!

"There is no other service comparable to Air Express. We would be just a local business without it.

"Yet Air Express rates are usually lowest of all. For instance, a 10-lb. shipment from Tampa to Detroit costs $5.06. That's 68¢ less than the next lowest-priced air service."

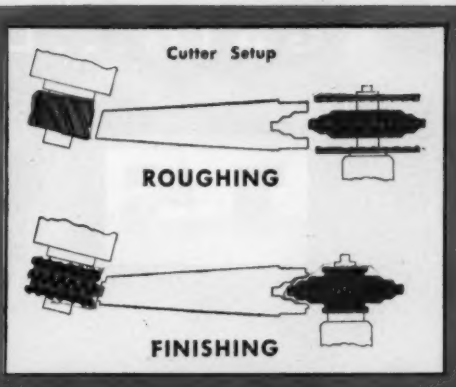
Air Express

GETS THERE FIRST *via U.S. Scheduled Airlines*

CALL AIR EXPRESS . . . *division of* **RAILWAY EXPRESS AGENCY**

CUSTOMER SPECIFIED

KEARNEY & TRECKER MILWAUKEE DESIGNED



A leading electrical equipment manufacturer needed a production machine to rough-and-finish mill a variety of sizes of chrome-nickel-steel steam turbine blades — 4" to 30" long. Specifications called for a machine that would cut milling costs and maintain accuracies within thousandths of an inch. Solution: They called on Kearney & Trecker to develop and build the machine.

Production rates are dependent upon workpiece size. For example, twenty-seven 13½" chrome-nickel-steel blades are rough-and-finish milled per hour by this new Kearney & Trecker Two-Spindle Bed Type machine.

Rectangular index table with two work-holding fixtures enables the operator to unload and load one fixture while the other is in work. This sequence eliminates down-time and keeps production constant.

Dovetail end of blade is rough-and-finish milled with the lower spindle, using a combination of special form and side mills. Head, mounted in an inverted position on a saddle, is counterweighted. Tenon end of blade is milled with the upper vertical head which moves in an arc on radial ways . . . angular adjustment of 45° is possible.

Other machine features include air-clamping for machine table . . . automatic chip conveyor . . . high volume coolant pump . . . easy to change pick-off gears for each head to select exact desired spindle speeds.

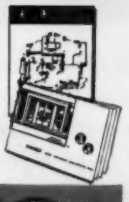
New production efficiency starts with Kearney & Trecker Milwaukee machine tools

Kearney & Trecker automatic production machines perform many operations to exacting accuracies and at lower cost. But most important to you — it's accomplished by combining standard design components with a minimum of special engineering. This means you get the production you want, the economies you need, from job-proven designs with minimum of capital investment.

With more than 50 years' experience in machine design and manufacture, Kearney & Trecker has the all-around ability to meet your production needs. Take advantage of these abilities. They can pay off in lower machining costs and more profits for you. See your Kearney & Trecker Special Machinery Division representative. He'll be glad to help you with your production requirements. Call him today.

BOOTH NO. 508

For more details on machine illustrated ask for Data Sheet No. 1067. Booklet "Doorway to a proven method for solution of big and small metalworking problems" is also yours for the asking.



Builders of Precision and Production Machine Tools Since 1898

AGAIN...LATHE LEADERSHIP

15 NEW

Powerturn LATHES

NEW FEATURES FOR ADDED PRODUCTIVE CAPACITY AND GREATER OPERATING CONVENIENCE . . . WITH TRADITIONAL LODGE & SHIPLEY ACCURACY AND RUGGED STRENGTH

With apologies to so many loyal lathe users who've stoutly claimed Model X Lathes as the "greatest ever" here's a worthy successor to that famous series!

From headstock to tailstock . . . and down to the floor . . . POWERTURN Lathes are newly designed to facilitate turning to higher levels of profitable lathe operation. New features add importantly to Lodge & Shipley Lathes' ability to produce more at lower costs.

Start turning problems into profits . . . make your next lathe a Lodge & Shipley POWERTURN Lathe . . . newest and best! The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

HEADSTOCK
. . . Computing head with time-saving speed selection, positive brake, built-in horsepower ammeter

CARRIAGE AND APRON
. . . greater swing over cross slide, micrometer indication of carriage movement, hardened and ground, steel cross slide ways

FEED AND THREAD GEARING
. . . new tilted index plate and levers for easy selection

CROSS FEED AND TOP SLIDE DIALS
. . . large, direct reading in .001" diameter increments

COMPOUND REST
. . . square base rest reduces overhang, increases strength

BED AND BEDWAYS
. . . new chip and coolant pan, easy mounting of guards, removal of chips

TAILSTOCK
. . . spindle hardened and ground, front-mounted handwheel, tailstock quickly moved, positively locked

13", 16" and 20" Standard—Engine, Toolmaker, Gap, Manufacturing and COPYMATIC Types

new POWERTURN literature available now!

Bulletins:

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#303—*16" Engine Lathe*
#304—*20" Standard Engine Lathe*
#305—*13" Toolmaker Lathe*
#306—*16" Toolmaker Lathe*
#307—*20" Standard Toolmaker Lathe*

POWERTURN LATHES are available on Lodge & Shipley Lease and Deferred Payment Plans, details on request.

FROM LODGE & SHIPLEY!

Featuring the time-saving new

Computing HEAD

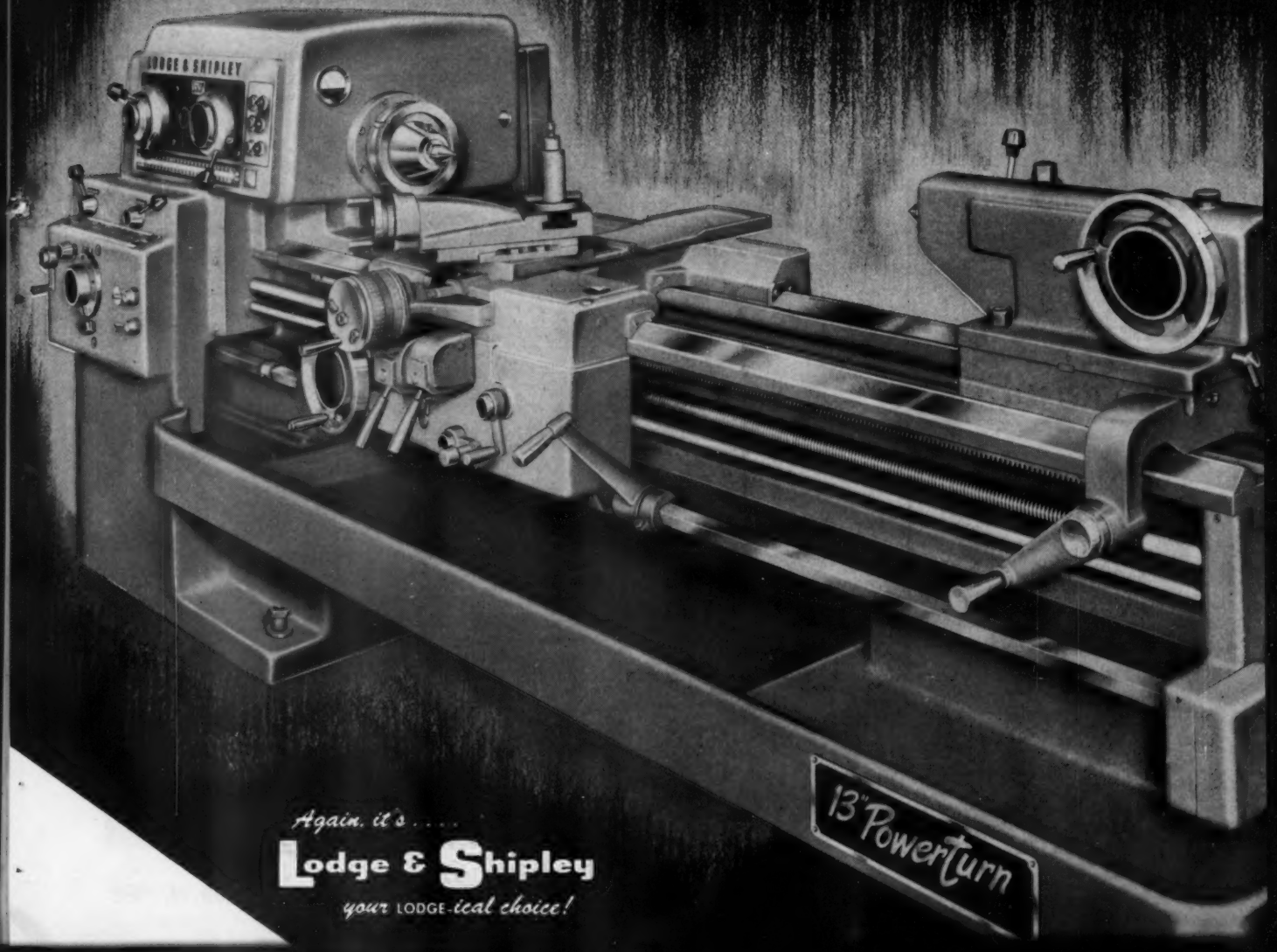
. . . fast, fool-proof indication of speed lever settings!

and, ***Centri-trol*** **CONTROLS**

. . . all controls conveniently grouped, distinctively shaped!

See it NOW... See it at The MACHINE TOOL SHOW!

SEPTEMBER 6th-17th, BOOTH NO. 502



Again, it's . . . .

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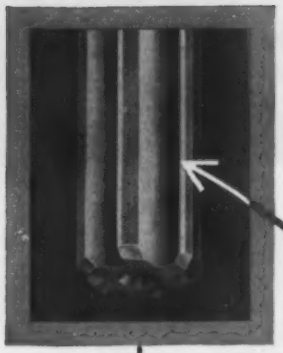
your LODGE-*ical choice!*



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L+I gives you the edge on production

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L&I

LAVALLEE & IDE, INC.
CHICOPEE, MASS.

Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

Tons of Tungsten

I believe that the mechanical world has a right to know that there is plenty of tungsten available both for cutting tools and, more importantly, for elements of machine construction. Tungsten-carbide boring bars are the forerunner of machine elements (not cutting tools) which, because of the high YME (three times that of steel), provide rigidity.

Long-range developments utilizing tungsten-carbide alloys in cylinder liners to operate at three times the psi attainable with steel cylinders; spindles; large valves; and in brief, critical parts which must resist forces, are being held up because of an unfounded notion that there is not enough tungsten. Temporarily the tungsten market is sustained by stockpiling purchases at $63 a unit. (A unit is 20 lb of tungsten trioxide or 15.86 lb of tungsten metal.)

The US Bureau of Mines "Mineral Industry Survey," Mineral Market Report #2371 "Tungsten in 1954," gives the astounding story of nine times as much tungsten mined (in the US plus imports) as was consumed in all forms in that year. The balance went into the stockpile.

From best information available to me, I guess there is about 20 years' supply of tungsten in the stockpiles accumulated by the Government since 1940. It was all needless expense to the taxpayer. As I reported in *Iron Age*, November 14, '40, 1 lb of tungsten in the form of Kennametal did as much cutting as theretofore had required 60 lb in the form of 18:4:1 HSS. Zay Jeffries, Carboloy Co, later placed it at 100:1, and today, with mechanically-held Kennamatic and Kendex tooling, the ratio is even higher than when I wrote in 1940.

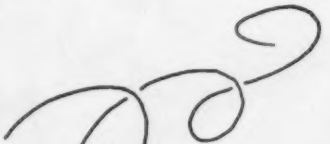
It seems incredible that, because of lack of information and because of propaganda by mining interests and politicians, including some in the State Dept, the Government should have spent $¼ billion unnecessarily. That much wealth has been seized and sterilized. There never was any emergency in tungsten supply. Nor do I know of any uses for armament, in armor-piercing projectiles, which could not have been met as regards raw material. The bottleneck is in refining and engineering, if any exists. At present, the carbide industry has excess capacity.

Why does that affect your readers, the tool men? It affects them in

GRINETICS

By D G SMITH

OIL TREATMENT



BANJO FITTING

CAPITALISTIC PROPAGANDA

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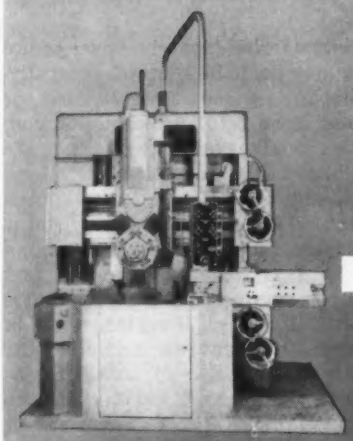
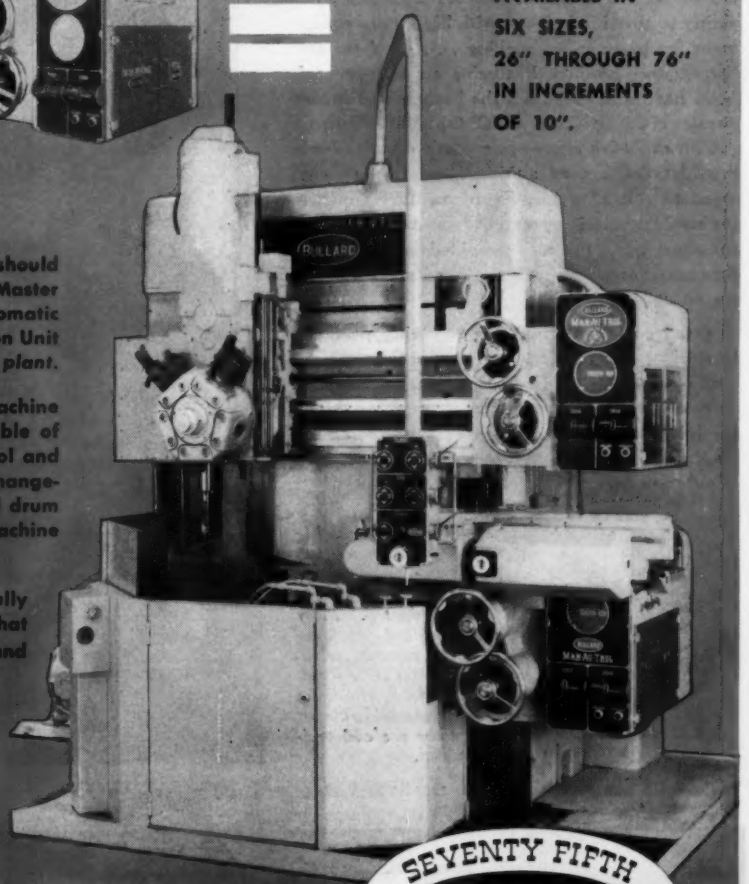
Machine Tools for Today and Tomorrow!



The most versatile vertical turret lathe available to the metalworking industry...

... Man-Au-Trol, Model 75

AVAILABLE IN SIX SIZES, 26" THROUGH 76" IN INCREMENTS OF 10".



Versatile because at the time of purchase should your production output require only a Cut Master V.T.L., Model 75 and later increase so that automatic operation is desirable, a Man-Au-Trol Conversion Unit can be added to the Cut Master *right in your plant.*

The Man-Au-Trol Conversion Unit directs the machine through all the functions the machine is capable of performing — automatically — by use of control and function drums. Machine down time for job change-over is reduced to a minimum since the control drum can be pre-set in advance and placed in the machine in a matter of seconds.

Your Bullard Sales Engineer will be glad to fully explain all of the technological advantages that are incorporated in the Man-Au-Trol, Model 75 and apply them to your machining problems.

PLAN TO VISIT OUR EXHIBIT AT BOOTH 1213

SEVENTY FIFTH BULLARD ANNIVERSARY

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pieces per hour
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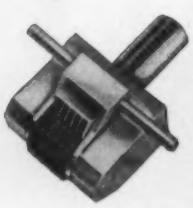
FEATURES
Cyclomatic Control

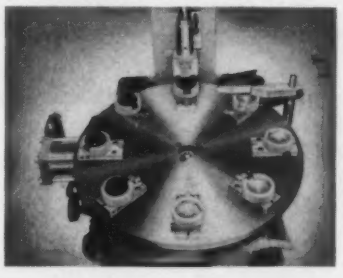
This new Model 400 dial feed marking machine is another example of NOBLEWEST'S unique ability to provide industry with high speed equipment for permanent marking . . . *good for the life of your product.* Featuring an air operated press head and dial feed, the basic model incorporates NOBLEWEST CYCLOMATIC Control . . . an exclusive electro-pneumatic circuit which provides continuous automatic cycling at any speed to suit operator. Supplementary controls for semi-automatic operation from a foot switch, for short runs, are also provided as well as independent operation of press head and dial feed for set-up purposes.

If you have a marking or numbering problem in steel or other metals—wood, fibre, hard rubber, or plastic—NOBLEWEST makes the machines, dies and workholding fixtures for doing the job *better, faster* at *lower cost.* For complete details, write Noble & Westbrook Mfg. Co., 17 Westbrook Street, East Hartford 8, Conn.

This close up shows Model 400 tooled for serial numbering plastic part shown above. Operator simply loads dial, parts are then automatically ejected after being numbered.



NOBLEWEST Automatic Numbering Heads such as used on the machine at right are standard in the marking industry. They offer unlimited applications for constant, selective and consecutive numbering. Made to the most exacting standards of quality, they are competitively priced.



Copyright 1955—The Noble & Westbrook Mfg. Co.

MARK IT BEST WITH
NOBLEWEST IMPROVED MARKING DEVICES
NOBLEWEST
ORIGINATORS OF THE ROLL MARKING PROCESS
EQUIPMENT FOR MARKING · GRADUATING · EMBOSSING · NUMBERING

their planning for innovations in uses of tungsten-carbide alloys. If engineers knew that tungsten would be plentiful for the next 20 years, they could plan on larger uses for it. If they start now, it will keep things going two or three years from now because, as you know, it takes time

for engineering ideas, however sound they may be, to be adopted generally.

Stockpiling ends June 30, 1956, or sooner if we get 3 million units from domestic mines before that time. We shall have that accomplished by June 1956. But I read that it is proposed to extend the stockpiling act. That is economic folly, misdirecting human effort. I say that despite the fact that our company owns and operates the third largest tungsten mine in Nevada, the Nevada Scheelite Co. For the long-range advantage of industry, and indeed for that of the tungsten miner, too, the Government should cease taking taxes from industry only to use the money to take the valuable mineral tungsten out of use.

We at Kennametal, and our friends in industry, have ideas for fruitful economic use of tungsten once it is released from control of the deadening hand of Government. Many are deterred from starting the engineering and experimental work now, because of lack of information as to the supply of tungsten. Perhaps your paper would do a service to all by reporting the facts.

Philip M. McKenna
President, Kennametal Inc.
Latrobe, Pa.

Management

Too many people today think that management involves simply drawing up a set of rules. I define it as knowing when to bust the rules.

If rules are all you need, then you also need only a policeman to enforce them. But rules are drawn up to cover routine happenings—they rarely cover emergencies. And emergencies are what count.

I wrote the following lines many years ago, but they seem to fit the

modern picture just as well as they did when first I wrote them.

Management isn't a set of rules,
It isn't just buying a mess of tools,
Or tilting back in an office chair
Blowing nice smoke rings into the air,
Nor quitting the office after lunch
To play around with the golfing bunch.

Management means to get things done,
All parts together, and not just one,
Having materials ready when
Machines are ready, and likewise men,
Planning the work so it all comes through
Ready for the assembly crew.

Management knows how to handle men,
Not iron-fisted, but seeing when
Things need changing in any way,
Treatment, comfort, or even pay.
Management must lead, not drive,
Must look ahead, must be alive
To changes now, and in days to be,
As we progress—to keep trade free.

Fred H. Colvin
Point Pleasant, NJ

Wrong Conversion

With surprise I read in your pages (*AM*—April 11 '55, p 240) that the German Pfund should be multiplied by 1.23 to receive the equivalent in pounds. With a German Pfund equalling 500 grams and the pound equalling 453.6 grams, the factor is 1.1023. Such slips endanger somewhat the trust in figures given in American Machinist.

Oswald A Schmidt
Wexford, Ont, Canada

We regret the error, but it was not made by us. The authors of the book in question gave the pfund as 560 grams, making the factor 1.23. We took up the matter with them, but they have not acknowledged the error or explained the origin of the 560 grams.—Ed.

Maintain Schedules | Obtain Flawless Cutter Performance | Eliminate High Costs

"BRIDGE the GAP"
EFFICIENCY Between ECONOMY

EQUIP *with*
OLIVER ACE
Universal Tool and Cutter Grinders

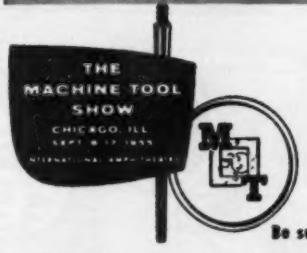
An Oliver ACE in your toolroom will consistently machine grind cutters efficiently and accurately and, at the same time, eliminate unnecessary and excessive time . . . labor . . . and operating costs.

The EFFICIENT Oliver ACE grinds cutters and tools to a higher degree of precision, including tungsten-carbide and high speed milling work. In addition, the ACE handles a wider variety of cutters than ordinary cutter grinders.

The ACE is easy to set up . . . needs only a small amount of floor space . . . requires less outlay of dollars. Its simplicity of design and operation makes economy of motion and fast grinding certain . . . cuts time lags to the bone.

PROMPT DELIVERY

The Oliver ACE is simple-to-operate . . . requires no computation . . . direct reading for clearances reduces fatigue and eases operators' jobs in grinding the most difficult cutters. Install an Oliver ACE Universal Tool and Cutter Grinder in your toolroom now . . . you'll be amply rewarded.



Be sure to see the Oliver Line—Booth 604 at The Machine Tool Show.

Priced to meet your budget, the ACE excels for grinding face mills up to 15"—also, slab mills • slitting saws • dovetail cutters • angular cutters • double angle cutters • Fellows helical cutters • reamers • taper reamers • production gashing and carbide tipped circular wood saws.

2 MODELS: Standard and Heavy Duty (illustrated)
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MACHINE TOOLS by OLIVER include:
AUTOMATIC DRILL GRINDERS
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UNIVERSAL CUTTER AND TOOL GRINDER

Equipped with famous Pope Tilting Head with motorized 1 h.p. spindle. Easy to adjust and use. Saves time and money on every tool grinding job.

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Hydraulic Feed
High Speed
SURFACE
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15" x 24"

Hydraulic rapid traverse, hydraulic wheel truing.

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OPTICAL COMPARATOR

For accurate checking right in the shop. Optic arrangement permits use in bright light. Precision-built throughout. Only $985.00.

THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATER

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UNIVERSAL & TOOL GRINDER
12″ x 30″

A truly universal grinder for precision external, internal and circular form tool grinding.

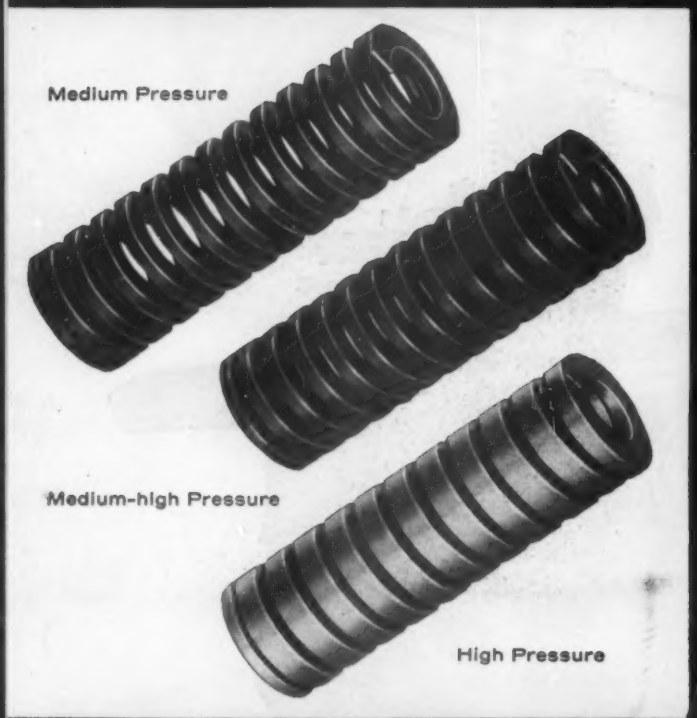
Descriptive literature on request.

OVEL PRECISION GRINDERS | BENTON HARBOR MICHIGAN

HYDRAULIC & HAND FEED SURFACE GRINDERS • UNIVERSAL CUTTER & TOOL GRINDERS • DRILL GRINDERS

See Danly's New Die Spring Line...

3 COMPLETE PRESSURE RANGES TO CHOOSE FROM!



Now, you can design longer spring life into your dies. The new Danly Die Spring Line offers you 236 different springs to choose from—with the range of characteristics you've been looking for. Design of all springs in this new line is based on fatigue testing through millions of compressions at recommended loading and deflection.

Select the die springs you need from the new Danly line and get exactly the deflection, spring rate and size you want.

Shown above is a spread from the new Danly Die Spring Catalog—detailing the simplified spring selection procedure worked out for you.

Send For New Catalog...

The new Danly Die Spring Catalog makes selection of the right die spring easier than ever before. Contains complete pressure and deflection data, as well as dimensions. Here are some of the unusual features of this catalog:

- **New Method of Selection** . . . new "step-by-step" selection method simplifies choosing the proper die springs to meet any given problem.
- **Simplified Charts** . . . the regular spring tables are read "straight across" and contain complete details to minimize confusing cross references. Send for your FREE copy today.

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DIE SETS . . .
STANDARD OR SPECIAL
DIEMAKERS SUPPLIES

DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue • Chicago 50, Illinois

Spot News of Metalworking . . .

- **The new Ford nameplate will probably be the "Edsel"**—at least that's the name the forthcoming auto line is called around the Special Product Division where it's being readied. Ford would like the name for sentimental reasons —because the late Edsel Ford was old Henry's son, and he's the father of President Henry Ford II—but they're afraid the name lacks popular appeal.

- **New twist on the guaranteed annual wage:** one GM plant has signed a contract with the Road Machinery Workers requiring that the company deposit 5¢ in an individual trust account for each employee for each hour worked.

Air Force Heavy Press Program is going "too damn slow" in the opinion of one airframe maker. It's not the presses' fault. Airframe people are slow to take full advantage of them because: (1) they're afraid weight savings don't justify high die costs, (2) they doubt whether tolerances will be close enough to eliminate extensive finish machining, (3) they're awaiting new technical developments.

- **Auto industry will spend $1.2 billion for capital goods in 1957,** 40% of it for new plant construction, a highly reliable Detroit source estimates. And tooling outlay for bumper-to-bumper changes in 1957 will be "stupendous."

- **Ultrasonic inspection of welds in building steelwork** is being applied for the first time in Canada on the framework of the new $20 million addition to the Toronto General Hospital. The lightweight, portable unit was made in England and is easily handled by one man. Power is supplied from a small generator unit on the ground.

- **Colored anodized aluminum stampings** will be a feature of the radiator grille in the '56 models of the one style-setting automaker.

Apprentice training registrations are on the upswing for the first time since Korea, according to Bureau of Apprenticeship. Currently, the metalworking trades have 32,504 registered apprentices.

- **Upwards of 10-million lb of machine tools are already in place** at Chicago's International Amphitheater in preparation for the Machine Tool Show. They're performing miracles of machinery moving and installation to be ready for the Show's opening September 6. For an on-the-spot report, see p138.

- **Average U S production foreman earns $6241 a year,** is 45 years old, has held his present job 8½ years, supervises 42 workers, according to an American Management Association survey of 6500 foremen in 100 firms. Major department foremen average $7416, general foremen $8479, and maintenance foremen $6822 a year. Durable industries pay higher than soft goods.

- **Machine tool builders are responsible for whole sections** of Plymouth's new V-8 engine line. For instance, the maker of automatic hones must see that his machines are well-engineered and installed on time. And he is responsible for performance of such subcontracted components as automatic gaging devices that go into his machines. (see p88A)

Grinding 5-Start Worm with 4" Lead

STANDARD STYLE 36

EX-CELL-O *Precision* THREAD GRINDER

In the photograph at the left the operator is grinding a worm shaft for use in a special machine. The part is about 22" long and the worm is 4½" long, 3.430" O.D., has 5 starts, a pitch of .800", a lead of 4" and a tooth depth of .5454". The worm was ground in two operations on a standard Style 36 Thread Grinder. It was rough ground from the solid, hardened, then finish ground.

For complete information and specifications on the Style 36 and other Ex-Cell-O Thread Grinders contact your local representative or write today to Ex-Cell-O.

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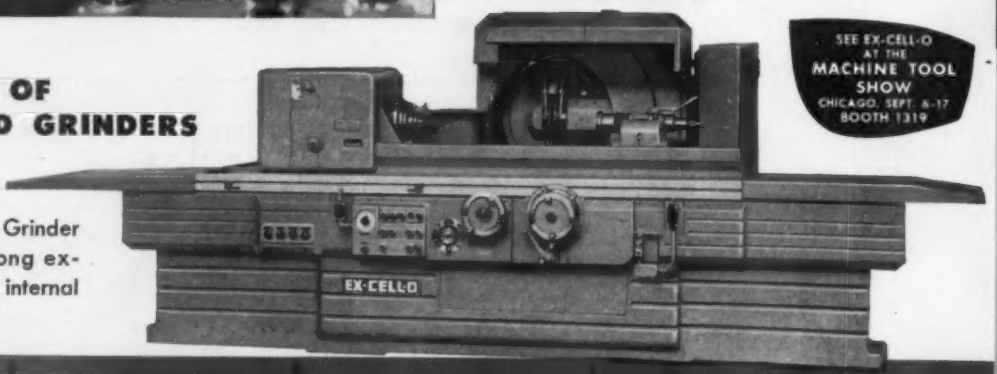
EX-CELL-O for PRECISION

SEE EX-CELL-O AT THE MACHINE TOOL SHOW CHICAGO, SEPT. 6-17 BOOTH 1319

A COMPLETE LINE OF PRECISION THREAD GRINDERS



STYLE 36 Precision Thread Grinder—a versatile machine for long external threads, available with internal attachment.

STYLE 50
Precision Thread Grinder—a versatile machine for external work, also available with internal attachment.

STYLE 33
Precision Thread Grinder—a high production machine for external work.

STYLE 39-A
Precision Thread Grinder—a high production machine for internal threads.

STYLE 120
Our largest Thread Grinder. Grinds 10 feet of thread in one setting. Accommodates 12 feet of stock between centers.

EX-CELL-O CORPORATION • Detroit 32, Michigan

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Ad 55-19

Washington . . .

Businessmen-in-government . . .

Big issue in the next election is sure to be the performance of Republican businessmen in the government. Democrats are arguing that too many businessmen, brought to Washington by the Eisenhower administration, have used public office to further their private business interests.

The big target, of course, is Harold E Talbott, who recently resigned under pressure as Secretary of the Air Force. In his much-celebrated case, there was no clear-cut violation of any law. Instead, the more foggy matter of ethics was involved. According to the record, Talbott remained as partner in a management consulting firm when he became Air Force Secretary. The firm had some clients with Air Force contracts. Talbott drew $132,000 from the partnership. Meantime, he used his Pentagon post to recommend the firm to prospective clients with Air Force contracts.

Talbott's resignation hasn't settled the issue at all. Democratic fire turned to the related matter of "WOC's" — businessmen who serve the government without compensation. In extending the Defense Production Act, the Democratic-controlled Congress tagged new restrictions on to the law affecting the government's use of WOC's. Included is a requirement that WOC-appointees file detailed, semi-annual reports of all their business connections.

Next session of Congress will probably take on the issue of businessmen-in-government all over again. Many lawmakers want a clearer law that the rather vague "conflict of interest" on the books.

Meantime, it's likely that Talbott's successor will not be a businessman — at least not some one from aviation. Speculation right now centers around two political pros, Rep Carl Hinshaw (R, Calif) and Indiana's Governor Craig.

Fast writeoffs for some plants . . .

While the official decision on what happens to fast tax writeoffs is still to come, the betting is that accelerated amortization will be continued for almost 12 types of plants. Right now, the mobilization officials are talking about classifying the 80-odd industry expansion goals that still qualify for rapid amortization into three categories — "direct defense" (like production facilities for military procurement), "direct defense-supporting" (like power facilities for military and defense needs), and "defense-related" (like scientific instruments).

The officials figure that about 12 of the goals fit into the first two categories. Goals tagged in the third category will likely be suspended until a full-scale review of supply-requirements estimates is made, then most will likely be closed. On many products, all this is only academic. The fast tax has proven an inadequate lure for the amount of private expansion sought by the mobilizers in several industries.

Copper and aluminum supplies . . .

Government officials think the aluminum shortage is easing. On the short-range side, production is coming in from Anaconda's new plant. Long-range, there may be more expansion from the big producers, Alcoa, Reynolds, and Kaiser. Washington is now considering additional expansion incentives to give this a push.

But there's a price to pay. Alcoa has hiked prices on aluminum pig up to 1.2¢ a pound. The price boost came on the heels of wage increases granted recently to Alcoa workers. The price hike in ingot will soon work through to higher prices on fabricated shapes.

Meantime, the copper shortage has become tighter. Government officials have been seriously talking priority controls over copper for civilian products. But right now it's unlikely that such strict measures will be imposed.

Almost 15,000 tons of copper were lost during the smelter strikes. That's almost the amount of copper initially earmarked for the stockpile for third-quarter delivery — which was eventually deferred to allow producers to meet consumption needs. There's still talk about tapping the stockpile for more copper. But chances are this won't be done. Meanwhile, tighter controls have already been clamped on copper exports; these may be made tougher yet.

Earth satellite plans . . .

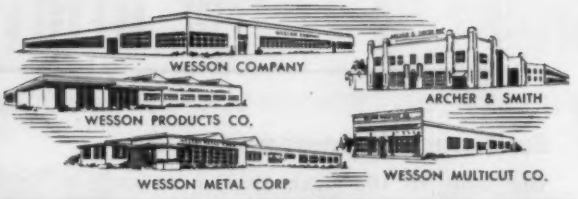
President Eisenhower's approval of a plan to launch small, unmanned, earth-circling satellites will mean a production project that may cost close to $100 million. No exact figure has been disclosed officially, other than the $10-million estimate made for the satellite itself. Launching equipment may cost up to 10 times that much.

The project falls into two parts — the rocketry needed to get the satellites up to orbit and speed, then the satellite. Most likely, contracts will be let on each system, not on individual components. This would be in line with Air Force's "Weapons System Concept" of procurement. The Pentagon would let the contract on the rocket system, the National Science Foundation on the satellite. Both contractors would, of course, have to work closely with each other. The satellite will likely be launched in mid-1958.

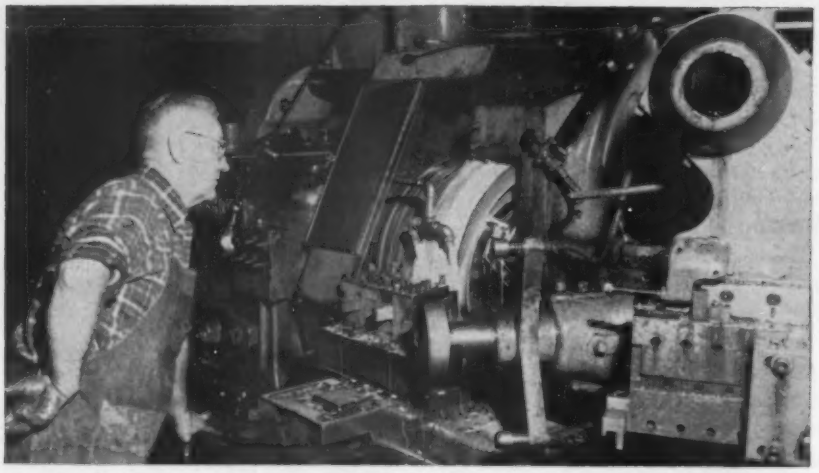
New Air Force contracts . . .

Air Force has signed speed-up development contracts with (1) Lockheed, Northrup and North American for a new supersonic long-range interceptor, (2) Republic and North American for a new supersonic fighter-bomber, and (3) Martin and Douglas for a supersonic tactical bomber. The Air Force hopes to cut production time more than a year by getting delivery on actual production models from firms whose designs are picked.

carbide NEWS



New Grade 26 Nearly Universal



Straddle facing the O. D. of a forged steel final drive gear on a 4F Gisholt Fastermatic lathe using Wessonmetal Grade 26. Tool life increased 40% over other carbides.

Closeup of straddle facing operation. Two solid carbide Grade 26 inserts are used. Job is being done at 260 sfm and 40 rpm. Feed varies from .017" to .020" with average depth of cut from 3/16" to ¼".

Grade 26 produced a 30% increase in tool life on a severe interrupted cut on a tractor brake band anchor. Standard Wesson band-type Multicut is used on a Warner & Swasey turret lathe. Cutting speed ranges from 280 sfm down to zero. Feed is .027", depth of cut is ⅛".

tools Wesson carbide Wessonmetal

Useable on 95% of steel cutting operations, it boosts tool life 40%

The nearest approach to a universal cutting grade available to the metalworking industry is a new carbide designated as "Grade 26" by Wesson Metal Corporation. Created primarily for all types of steel rough and semi-finish machining, it is also proving highly effective on some finishing operations.

Problems of carbide selection are greatly simplified by Wessonmetal Grade 26, since it cuts down the number of grades required for steel cutting operations by as many as four grades.

Optimum performance for Grade 26 extends over a range of 100 to about 400 sfm, covering 95% of steel machining operations encountered in industry today.

Much of Grade 26's record of outperforming all other steel cutting grades in 95% of all machining operations on which it has been applied is due to its superior edge cutting strength. Grade 26 was developed to have high red hardness and high thermal conductivity in order to function without any drop in performance at the elevated temperatures generated at high cutting speeds.

Improvement in tool life over all other grades has averaged about 40% on applications to date. Extensive tests have been conducted on a wide range of materials ranging from conventional steels to the high alloys used in high temperature applications.

Now in full production at Wesson Metal Corporation's new metals plants in Lexington, Ky., Grade 26 provides the answer to lower tool costs over a broad range of metal cutting operations.

For answers to your machining problems write:
WESSON COMPANY
DEPT. AD
1220 Woodward Heights Blvd.
Detroit 20, Michigan.

Detroit . . .

Chrysler's 1956 cars . . .

. . . will draw more than passing attention this fall, outsiders believe, because of the magnitude of changes in design and engineering features.

Normally, it might be expected that the corporation would have bowed with only slightly altered autos, since the '55 models represented major body changes. Brand-new body shells are not in prospect for the new offerings, but impressive changes nevertheless are apparent, and so extensive that further sales gains next year may well be in the cards for the Highland Park producer.

Contributing to the generally rosy outlook for Chrysler products is an appealing engineering innovation: pushbutton transmissions. Instead of mounting a gear selector lever in the instrument panel, as in '55 models, the '56s will show a cluster of four buttons installed at the extreme left end of the panel. When he punches one of the gear selector buttons, the driver will be exerting no more energy than he does in changing stations on the car radio.

Packard, too . . .

. . . will have pushbutton transmission operation, but Chrysler, introducing new models earlier than Packard, probably will create the widest wave of conversation with the feature.

If auto production has surprised you . . .

. . . be assured you haven't been alone. Even the top auto economists who live with production projections day in and day out have revised estimates of 1955 output from time to time this year.

After the total for the first half of the year hit nearly 4.3-million units, a sharp drop-off after early July was widely anticipated. But in July, the industry turned out 663,000 cars, and *Ward's Reports* figures 611,000 cars will be assembled this month. By September 1, then, over 5.5 million autos will have been built.

Is production so far ahead of sales that dealers will be buried under '55 models this fall, as some Congressmen seem to believe? Not at Buick, according to Ivan Wiles, general manager. The General Motors vice president said that Buick built 425,000 in the first six months, and sold 406,000 of them domestically and in export, leaving its 3600 dealers with only 19,000 units. Buick, Wiles said, registered a higher percentage of its production than any other company in the industry, except Cadillac. First-half retail sales, Wiles said, would likely show Buick about 38,000 units ahead of fourth-place Plymouth. Across-the-board, no dangerous inventory problem was evident in last month's production-sales picture. The industry built 663,000 cars; dealers sold nearly 620,000. With automakers shutting down one by one for model changeover, production in September and part of October is certain to be reduced sharply.

Certain producers, caught with models less popular than others, beyond a doubt will experience problems when dealers go into inventory clean-up campaigns. But for the industry as a whole, there's no evidence now that a dangerous relapse is in the making.

The Ford-Chevrolet contest . . .

. . . is tighter than ever, possibly heading for a year-end finish as close as that in 1954. At last count, Chevrolet was leading Ford in production by more than 70,000 cars. But in the payoff department—actual sales to the public—Ford was ahead by a slender 1,100 units.

It's a safe bet . . .

. . . that Cadillac will announce still more expansion plans. The GM division hiked its production program to 150,000 cars in 1955 (against about 124,000 last year), but is still running a two-shift operation, with overtime added to both shifts occasionally. But even expensive overtime operations aren't producing all the cars Cadillac can sell.

The answer: new manufacturing facilities.

Update on Ford expansion . . .

. . . shows that the company has committed $820 million to construction of plants, office buildings and service facilities for the years ahead. Since 1946, Ford has built, or has announced that it will build, 33 new manufacturing and assembly plants, 20 parts depots and 19 major engineering, research and office buildings. Among projects not yet announced: new office and manufacturing facilities for Lincoln Division. Lincoln cars now are built by Mercury Division. Lincoln soon will get its own plant somewhere in the Detroit area. And soon, the company will begin to set up everything that's needed to produce a new line of cars, that product which will fit, price-wise, between Lincoln and Mercury. The Special Products Division, which will do all the initial work of designing, engineering and establishing manufacturing facilities for the new line, has lately been announcing the names of newly appointed executives in the sales and dealer planning offices, market analysis, and so on.

Michigan workers in the year 2000 . . .

. . . will be working only 30 hours a week but per capita income will be two-and-a-half times the present level. That's the prediction of Justin Whiting, Consumers Power Co chairman, who also foresees for that era homes that are fully air-conditioned, filtered and sterilized; ceiling and wall lights that go on automatically when a person enters a room; washing machines using supersonic waves to wash; etc. Things, it seems, are looking up.

5410

NOW CUT COST OF PRECISION GEAR PRODUCTION

THIS FEATURE: "*Independent* selection of speed, feed and indexing," sets the Hamilton Precision Small Gear Hobber apart from the field,

AND ENABLES the users of this machine to vary speed and feed to suit the material being machined.

THIS FACT, and a "reserve of accuracy" built into the machine, work spindle and hob spindle runout of less than .0002" as an example,

CONTRIBUTES to more gear precision with no sacrifice of gear production,

OR INCREASED gear production with no sacrifice of gear precision, ... OR BOTH!

Prices and specifications without obligation

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Address

The Hamilton Tool Company
830 South Ninth Street
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IT'S A **Hamilton Tool**

USE IT WITH CONFIDENCE

Machine Tools . . .

Air Force to place $52 million for tools . . .

The Air Force is on the verge of making the largest outlays from its 1955 program for reserve tools.

Before the end of August it plans to place orders for $52 million of machine tools. This will be on top of the $11 million already obligated.

Skin milling machines will be well up on the list of machines purchased. Giddings & Lewis is said to be slated for a good chunk of this business. Cincinnati Milling, Kearney & Trecker and Consolidated Machine Tool appear likely to participate too.

Other machines either bought or about to be bought include: profile milling machines, knee-type and bed-type milling machines in the larger sizes, and some stretch presses.

Vertical turret lathes are reported to be on the purchasing program of the Air Force. But it's not known what will be done about them.

Red tape in reserve tool program . . .

There is plenty of red tape to wade through before anything happens to the $100 million reserve machine tool fund voted by Congress for fiscal 1956, which began July 1.

It is unlikely that any of the money can be obligated for at least six months, according to one Pentagon authority. Here is the procedure to be followed:

The three services have been asked to submit by August 15 lists of projects, and equipment required for these projects, to the Office of the Assistant Secretary of Defense for Supply and Logistics.

This office will review the lists, screening out machines that do not meet the standards for the reserve program and deciding what types of equipment for what projects should be approved.

The assistant secretary then will submit his recommendations to Defense Secretary Wilson. Meanwhile, the Assistant Secretary of Defense for the Budget, Wilfred McNeil, will have had a chance to comment on the recommendations.

Eventually the Wilson-approved list of machines will go to the President's office, where the Bureau of the Budget will go over the projects.

People connected with the Air Force are not so pessimistic about the timing of the reserve program as the Pentagon official just cited. They believe it's a good bet that the 1956 money will become available to the services by September.

Dodge head to talk at AMTDA luncheon . . .

William C Newberg, president of Dodge Division of Chrysler Corp, will discuss the role of the machine tool industry in our industrial economy at the special "Pre-Show" luncheon featuring the annual meeting of the American Machine Tool Distributors' Association on September 5 at the Conrad Hilton Hotel in Chicago. Representatives of each machine tool building company have been invited to the luncheon as guests of the association.

General Williston B Palmer, vice chief of staff of the United States Army, also will address the group.

The AMTDA will hold its business sessions, aside from the luncheon, at the Sheraton-Blackstone.

The luncheon meeting will come one day ahead of the opening of the mammoth Machine Tool Show at the International Amphitheatre.

AMTDA will operate an information and message center at the Show. The association booth will be located between the show's two registration areas on the second floor. It will be arranged partially as a lounge so that visitors may use it as a meeting place and rest area. Uniformed messenger service will be provided.

Soviet machine building criticized . . .

Soviet machine building industry has been criticized by no less an official than Russian premier Bulganin for failure to introduce enough new equipment and to modernize existing machinery.

He said that immediately after World War II progressive production methods had been introduced. But lately little is heard about new, large-scale technological improvements in machine building.

Quoted in the government newspaper Izvestia, the premier said, "Our machine builders now confine themselves largely to utilization of already-assimilated technological processes, despite the fact that advanced techniques have been devised permitting a several-fold rise in labor productivity, sharp curtailment in consumption of metal, and manufacture of more items in the same plant area.

"**We cannot accept the situation** in our machine-building industry as normal when the proportion of high-output machine tools is declining because the machine tool industry does not turn out enough special equipment for making such tools. There is a serious lag in the production of forging press equipment.

"**Automation production processes are being introduced** too slowly. Available equipment at many machine-building plants is poorly utilized. Many of our plants still produce machinery inferior to that made by foreign plants."

BF

SHEFFIELD

Adjustable AIR GAGE TOOLING for Short Runs and Contingencies

SUCH AS:

- **Aircraft manufacturers, subcontractors and job shops having limited production.**
- **Accidental damage to a vitally needed single purpose gage.**
- **An unexpected engineering change involving part size.**
- **A short run of special parts for which no gages have been provided.**
- **A mistake or failure in ordering the needed single purpose gages.**
- **Sudden need for process gages at the production machines.**

Don't let any of these situations cause costly scrap, delays or embarrassing confusion in inspection, in the shop or in the toolroom. A small investment in the tooling here illustrated is your best insurance against unpredictable production losses.

Write Div. 600 for descriptive engineering data. *THE SHEFFIELD CORPORATION, Dayton 1, Ohio, U.S.A.*

Economical, Adjustable Balljet Spindle Kit

In 5 minutes you can assemble, for precision gaging, a spindle for ANY SIZE hole from 1″ to 3″ in diameter.

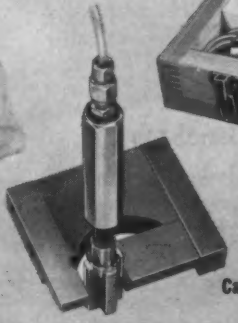
Consider economy for a moment. If the holes you may encounter vary in increments of .001″, this Kit provides the equivalent of 2000 Spindles at a unit cost of less than a dollar. If those increments are .0001″ you have available 20,000 Spindles at about a dime each. That is real economy.

No auxiliary equipment needed except conventional gage blocks—NOT EVEN ONE MASTER SETTING RING.

Adjustable Balljet Spindle Kit

Balljet Spindle assembled

Balljet Spindle in use



Calibrating Fixture

Adjustable Airebore Gage

Adjustable Airebore Gage

Airebore Gage in use

Airebore Gage assembled

The Airebore Gage can be set precisely to measure any diameter hole from 3″ to 12″. And like the Adjustable Balljet Spindle, it is set up with a calibrator and gage blocks. No master setting rings are needed.

The Airebore Gage is self-centering—needs only to be rocked in place for precision action. It is light in weight with all contact surfaces of tungsten carbide—nothing to wear out.

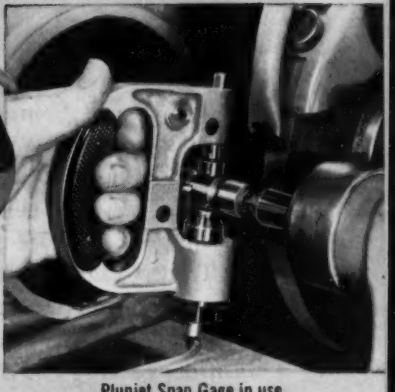
Three-Point Adjustable Spindles

Three Point Adjustable Spindles

The Three-Point Adjustable Spindles, four of them, cover respectively the ranges, 3/8″ to 9/16″, 9/16″ to 1″, 7/8″ to 1½″ and 1½″ to 3″. They can be set up with gage blocks.

Plunjet Indicator Snap Gage

Plunjet Snap Gage

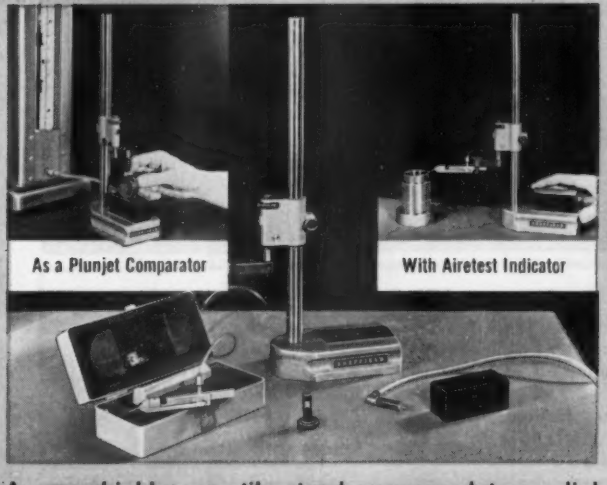


Plunjet Snap Gage in use

The Plunjet Gaging Cartridge may be substituted for the Dial Indicator to assure consistent, repetitive readings, especially when tolerances are .001″ or less.

Twelve Plunjet Snap Gage models cover the gaging range of 0″ to 12″. Larger sizes are available on special order.

Airetest and Plunjet Stand

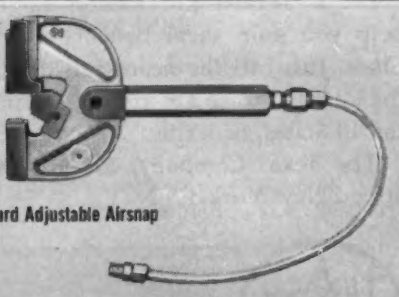


As a Plunjet Comparator

With Airetest Indicator

A new, highly versatile stand accommodates a dial indicator or an Airetest Indicator—also converts to a comparator by using a Plunjet and anvil as illustrated.

Standard Adjustable Airsnaps



Standard Adjustable Airsnap

The Standard Adjustable Airsnap in 17 models covers the range .2500″ to 5.500″. Up to 3.000″ the adjustable anvil has a maximum adjustment of ¼″. Above that the maximum is ½″.

MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD

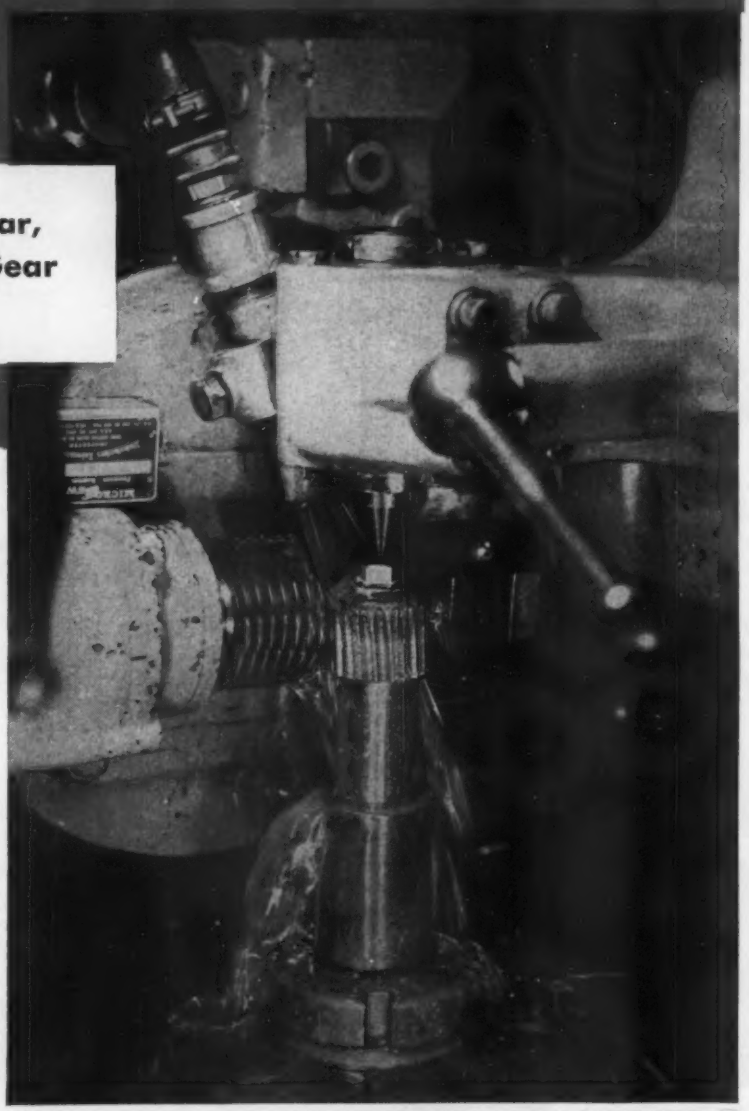
MANUFACTURE AND MEASUREMENT FOR MANKIND

See us at the Machine Tool Show, Booth 1305

7220

HOW WE QUADRUPLED TOOL LIFE—and cut tool cost 75%

—as told by George Edgar, Foreman, D. O. James Gear Mfg. Co., Chicago, Ill.



"THE JOB was hobbing a small helical gear," says Mr. Edgar. "With the cutting oil we have been using we averaged about 125 gears between resharpenings after using the full face of the hob.

"A Texaco Lubrication Engineer offered to help us do better. On his recommendation, we changed to *Texaco Transultex Cutting Oil B* and found we could run 500 gears before hobs had to be sharpened. This gave us four times the tool life and cut our tool costs on this job by 75 per cent."

Everywhere, *Texaco Cutting, Grinding and Soluble Oils* are helping to machine faster, better and at lower cost — regardless of the metal being cut or the method of machining it.

Let a Texaco Lubrication Engineer help you gain these benefits for your plant. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

JOB DATA

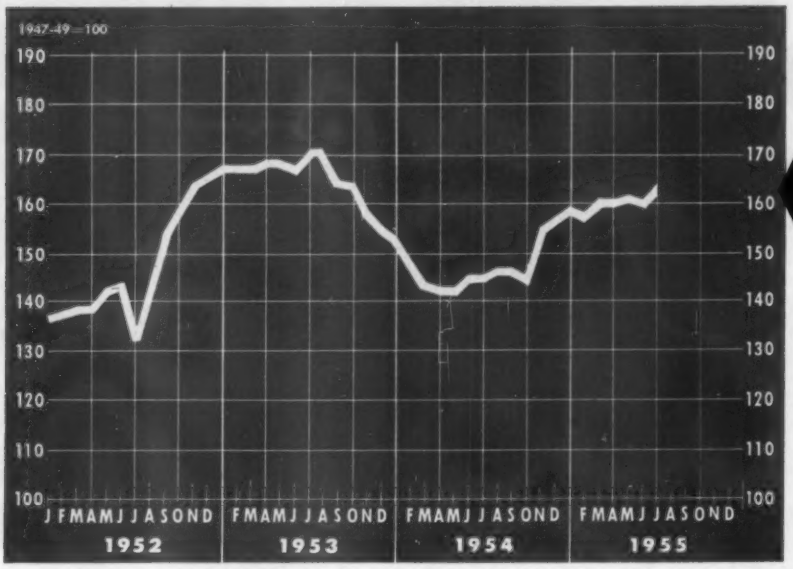
Steel *AISI 4140*	No. of teeth *19*
Hardness *Rc 30-35*	Diam. Pitch *12.037*
Diameter *1.75"*	Hob Diam. *3.50*
Face *0.75"*	RPM *110*
Shape *Helical*	Feed *0.070"*
	SFPM *101*

TEXACO

TEXACO CUTTING, GRINDING AND SOLUBLE OILS FOR FASTER MACHINING

TUNE IN . . . TEXACO STAR THEATER starring JIMMY DURANTE or DONALD O'CONNOR on television . . . Saturday nights, NBC.

Gaging Metalworking . . .



Production Index

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	JULY Estimated	JUNE Preliminary	MAY Revised	JUNE Year Ago
Total index	**163**	**163**	**162**	**146**
Machinery	136	134	123	
Electrical Machinery	187	184	173	
Autos	143	157	102	
Other Transportation	286	278	284	
Other Metalworking	138	135	125	

AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

Metalworking production stays high . . .

The nation's metalworking industries are coming into the final summer stretch without any letdown in the pace set at the beginning.

Things are off a bit, to be sure, in the automobile industry, where car makers are hurriedly switching to 1956 model runs. But the dip won't be for long.

The accelerated activity among machinery builders of all kinds offsets to a great extent the seasonal tendency to ease up a little in other quarters.

What's going on is best typified by the latest report of the American Supply & Machinery Manufacturers Association Inc. Its new order index of industrial supplies, at 194.5 for June, established a new postwar record. The June figure is almost double the base month of July 1948.

Big demand for steel . . .

Steel demand promises to be heavy the remainder of the year and well into 1956.

The truth is that some users are beginning to worry about deliveries early next year. That is an indication of how tight the situation has become in certain steel lines.

Order books for the fourth quarter, recently opened, are being filled quickly on major products.

Any idea of a summer dip has all but disappeared. The sole interference with a high rate of operations straight through the third quarter was the very brief strike preceding a labor settlement.

Most of the concern among steel users is from outside the automotive industry. These users are fearful that Detroit may put so much pressure on steel mills for first-quarter delivery that other customers will be slighted.

Scramble on for copper . . .

The long strike of copper miners has made itself felt in copper-using plants, some of which have been forced to shut down completely or to curtail severely their operations.

There is a scramble among users to get copper. Small consumers report that they are being approached by brokers with premium-priced foreign copper. There have been no takers as yet, however.

Screw machine products industry has been doing well. June shipments were the highest since October 1953. More than that, new orders were 54% ahead of the same month last year. For the first half, shipments were up 21%, and orders 58%.

Welding machine orders brisk . . .

The resistance welder people say that their incoming business the first half of 1955 soared 31% above the same period in 1954. Shipments were 22% ahead.

The industrial furnace industry is running 65% better than it was last year. Induction and dielectric heating are enjoying an even bigger boom.

Industrial furnace makers got $42 million of orders from January through June, the Industrial Heating Equipment Association Inc reports.

Woodworking machinery builders have had the same kind of upsurge in business as makers of other types of industrial equipment.

Gaging Business . . .

Price Index

	JULY Estimated	JUNE Preliminary	MAY Revised	JUNE Year Ago
Total Index	**135.5**	**135.0**	**134.7**	**132.5**
Metalworking Machinery		**152.0**	**149.0**	**141.6**
Other Machinery exc. Electrical		**139.7**	**139.5**	**137.5**
Electrical Machinery		**131.7**	**131.7**	**131.1**
Fabricated Metal Products		**130.8**	**130.8**	**128.7**

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

What will Federal Reserve Board do? . . .

The way business is booming along at record highs every month, business men are beginning to wonder whether the Federal Reserve Board will step in with new and different controls.

Bear in mind that the FRB has the principal responsibility for seeing that inflation does not take place.

It is supposed to keep the demand for goods within bounds by regulating the supply of money and credit.

It must, of political necessity, however, pursue its objective warily. It obviously would like to be able to slow down the boom without killing it.

It has seldom performed this delicate task in the past without some unhappy results.

Mild restraint put on housing . . .

The fact is that the Board has been moving vigorously in recent weeks to try to slow down the boom.

One important step was to secure the cooperation of the federal housing agencies in putting some limits on the amount of credit available for new housing.

The restraints admittedly are mild: 2% down-payment instead of none, and 25 years in which to pay instead of 30 (on mortgages which the federal government guarantees).

But since housing has lately been regarded as a sacred cow, any tightening up in that area is an indication that credit policy in general is about to get much tougher.

Banks and other lending agencies have been asked by the Federal Reserve to review the extra-liberal terms given on installment loans to buy new autos.

If this method does not prove out, more direct controls may be applied.

The Board is holding down, at the same time, the supply of funds that commercial banks have available for business loans. Banks are being required to maintain high reserves. This seems to point to higher interest rates and a more careful screening of loans.

Credit terms will have to get much stricter, however, before they hamper the larger corporations.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49 = 100)*	145.1	146.3	125.2
Steel ingot production (thousand tons)	2,278	2,190	1,527
Electric power output (million Kilowatt hours)	9,999	10,620	9,139
Production of automobiles and trucks	200,913	208,413	130,523
Engineering construction awards (*Eng. News-Record*, millions)	$317.7	$366.2	$368.6

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	397	390	303
Vacuum cleaners sales (thousands of units)	242	261	196
Washers sales (thousands of units)	360	342	303
Household electric ranges sales (thousands of units)	115	109	86
Radio production (thousands of units)	1,150	1,114	838
Television production (thousands of units)	490	467	544
Gear sales index (1947-49 = 100)	193.5	205.2	127.4
Foundry equipment new orders index (shipments, 1947-49 = 100)	N.A.	145.7	86.4

* Seasonally adjusted N.A. Not available

Automate for top performance with . . .

T-J Spacemaker CYLINDERS

CIRCULAR HEADS WITH TIE RODS
SQUARE HEADS WITH TIE RODS
40% SPACE SAVED
T-J
T-J
T-J
T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

Style SM5 shown

- The Only Cylinders with all the Extras as Standard
- OIL pressure to 750—AIR to 200 P.S.I.
- New Compact Design . . . Saves up to 40% Space
- Proven Performance . . . with Extra High Safety Factor
- Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Oil Cushion
- Hard Chrome Plated Bodies and Piston Rods (Standard)
- Only from T-J can you get these new ingenious cushion designs

More and more of industry's automation problems today—solved with T-J Spacemaker Cylinders! New compact design and many more plus features for a new high in efficient cylinder performance and dependability. Wide range of styles, capacities . . . to help you *save labor, reduce costs* on all kinds of push-pull-lift jobs. Send for bulletin SM-155-1. The Tomkins-Johnson Co., Jackson, Mich.

OFF SHELF DELIVERY

Member of the National Fluid Power Association

T-J TOMKINS-JOHNSON
RIVITORS · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHORS

Armco 17-7 PH Stainless Rates Tops at 300-800 F on

STRENGTH-WEIGHT BASIS

Guided Missile pressure-booster tank of Armco 17-7 PH is tested at 3500 psi pressure—a calculated average stress of 169,000 psi. This metal also is used for fuel tanks, to contain red or white fuming nitric acids and other oxidizers.

On a *strength-weight* basis, Armco 17-7 PH Stainless Steel is unexcelled for service at temperatures of 300 to 800 degrees F. In this temperature range, Armco 17-7 PH has these pound-for-pound characteristics in comparison with the best ferrous and non-ferrous metals:

**UNSURPASSED SHORT-TIME TENSILE STRENGTH*
**SUPERIOR SHORT-TIME YIELD STRENGTH*
**HIGHER STRESS-TO-RUPTURE STRENGTH*
**HIGHER CREEP STRENGTH*

Yet Armco 17-7 PH is not a costly metal. It is well within the stainless steel price range. Besides having fine corrosion resistance, it is readily fabricated and welded in the soft condition—draws and forms much like 18-8 stainless steel. After fabrication, it takes only a low-temperature double heat treatment at 1400 F plus 1050 F to develop its high mechanical properties.

Armco 17-7 PH is supplied in sheets, strip, plates, bars, angles and wire.

For complete data, just fill out and mail the coupon.

Armco Steel Corporation, 1525 Curtis Street, Middletown, Ohio
Tell me why Armco 17-7 PH is unexcelled on a strength-weight basis for service at 300 to 800 degrees F.

*Name:*_____

*rirm:*_____

*Street:*_____

*City:*_____ *Zone:*_____ *State:*_____

ARMCO STEEL CORPORATION 1525 CURTIS ST., MIDDLETOWN, OHIO

SPECIAL STEELS

SHEFFIELD STEEL DIVISION • ARMCO DRAINAGE & METAL PRODUCTS, INC. • THE ARMCO INTERNATIONAL CORPORATION

American Machinist

MAGAZINE OF METALWORKING PRODUCTION * ESTABLISHED 1877

Could This Be Mr. Khrushchev's Reasoning?

We have heard it said that Mr Khrushchev's joviality and sweet reasonableness in dealing with the West can be laid to an overwhelming desire that the Soviet Union devote its energies for some years ahead to building up a stronger and more stable economy.

No one short of Mr Khrushchev and his cohorts in the heart of the Kremlin can give the answer as to whether this is so. It is interesting, however, to speculate; and immediately certain data about development in the USSR come to mind.

More than a year ago the National Industrial Conference Board conducted an all-day meeting devoted to the industrial and competitive potential of the Soviet Union. Here are some of the facts mustered and presented at this meeting:

Comparison of raw materials production, plus electric power, shows a ratio of around one for Russia to three or four for us. Gross national product is in about the same proportion.

Mind you, these figures are based on comparisons that favor the heavy industries (metalworking, chiefly) in which Russia has concentrated her efforts. In 1953, over 70% of industrial production was in the heavy industries. One expert points out that this degree of concentration is without parallel in human history.

When it comes to consumer-goods output, the ratio is close to one to twenty. This is the field in which we as a nation excel and as one authority puts it, "the advantage is so overwhelmingly in our favor that it is simply like comparing a giant with a baby."

The present gap between Russia and us as producers of goods of all kinds is bound to be narrowed. But some of the experts feel that for the foreseeable future the Soviet economy is going to remain far behind ours. Russia is a pigmy alongside the American giant. And she will continue for a long time to be weak by comparison with us.

Now this all sounds comforting and we may be pardoned if we strut a bit. And it probably brings anguish to the Russians. **But whatever you do, don't make the mistake of underestimating them. They are indefatigable, they are ambitious, they know what they want and are out to get it.**

They have mapped out and carried into reality numerous five-year plans. They have realized the indispensability of a machine tool building industry and early started to create such an industry. In sheer quantity of machine tools installed in metalworking plants, they have an impressive record.

The facts lend support to the theory that Mr Khrushchev would just about give his right arm to be able to concentrate on narrowing the economic gap between the USSR and us. He wants to increase the output of goods for everyday living as well as to produce heavy goods so useful to a military economy.

If we have successfully probed into Mr Khrushchev's motives, there is potential danger for us. **The danger will come if we ever should let the gap between the two of us become too small. When and if that contingency should arise, we will have ourselves to blame.**

One way in which to guard against the danger is to keep our own productivity constantly rising by better management, better manufacturing techniques and better production equipment.

Burnham Finney

Here a Cincinnati Press Brake saves 3 ways...

Built at The Maryland Drydock Company, for the Westinghouse Electric Corporation these giant condensers are some of the largest ever constructed.

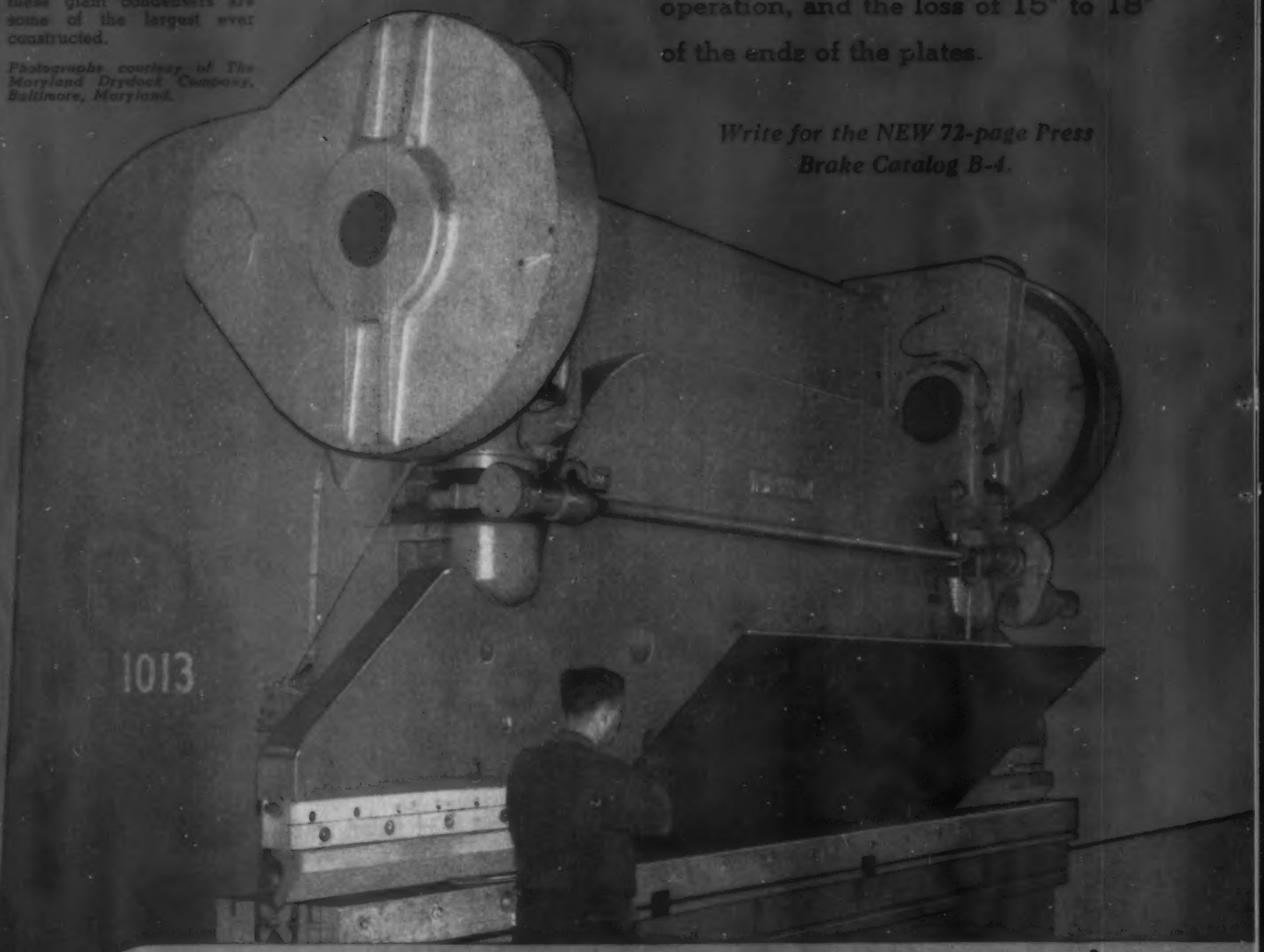
Photographs courtesy of The Maryland Drydock Company, Baltimore, Maryland.

- TIME
- NUMBER OF OPERATIONS
- MATERIAL

Crimping plate up to 3" thicknesses has cut roll-forming time in half at The Maryland Drydock Company.

The press brake crimps the ends of the plates with special dies, and has eliminated both the costly burning operation, and the loss of 15" to 18" of the ends of the plates.

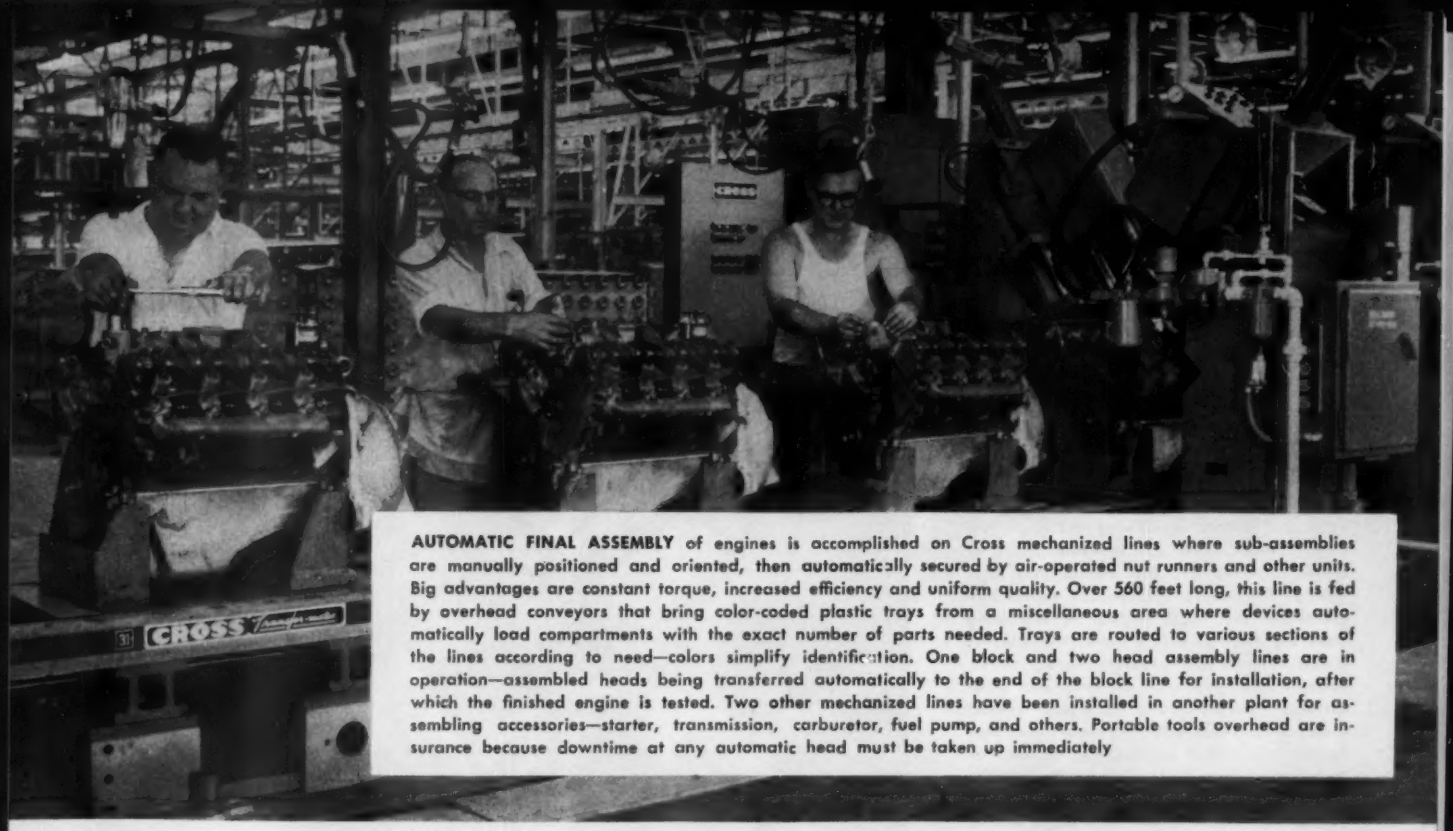
Write for the NEW 72-page Press Brake Catalog B-4.



THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI



AUTOMATIC FINAL ASSEMBLY of engines is accomplished on Cross mechanized lines where sub-assemblies are manually positioned and oriented, then automatically secured by air-operated nut runners and other units. Big advantages are constant torque, increased efficiency and uniform quality. Over 560 feet long, this line is fed by overhead conveyors that bring color-coded plastic trays from a miscellaneous area where devices automatically load compartments with the exact number of parts needed. Trays are routed to various sections of the lines according to need—colors simplify identification. One block and two head assembly lines are in operation—assembled heads being transferred automatically to the end of the block line for installation, after which the finished engine is tested. Two other mechanized lines have been installed in another plant for assembling accessories—starter, transmission, carburetor, fuel pump, and others. Portable tools overhead are insurance because downtime at any automatic head must be taken up immediately

Plymouth puts 'FORWARD LOOK' into V-8 production

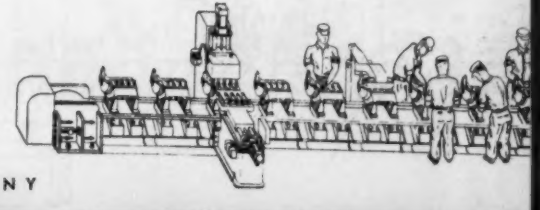
Using a new approach to planning and applying new concepts of quality control and manufacture, Plymouth has cut by two-thirds the normal three-year program of designing, developing and putting into production its new V-8 engine. Set up for 150 engines per hour, or triple the capacity of the previous plant, the new facility employs techniques differing sharply from those in other recently built engine plants. Innovations include: a unique method of assembling engines mechanically; wide use of horizontal spindle machines instead of vertical, and unusual equipment procurement methods. Automation and manpower are combined to increase machine efficiencies and reduce operator fatigue while plant maintenance is minimized by standardization and mechanization.

Here's the story—as told to George De Groat, associate editor

CARL J DEMRICK, vice president, chg mfg
L W BLANCHARD, exec assist to v p chg mfg
RAY McCARROLL, master mechanic
WM H ALLEN, plant engineer
PLYMOUTH DIV, CHRYSLER CORP, DETROIT, MICH

American Machinist

SPECIAL REPORT
NUMBER 400



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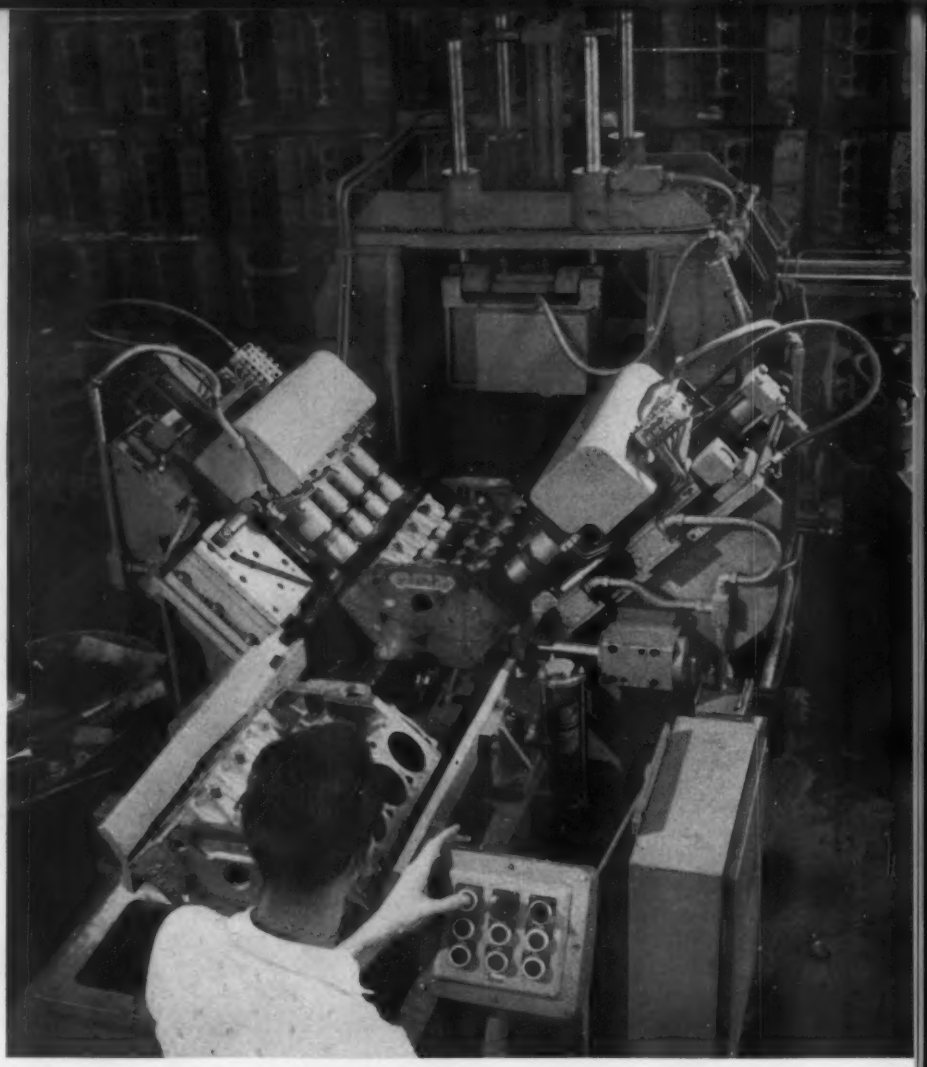
Plymouth puts 'FORWARD LOOK' into V8 production



QUALITY CONTROL STARTS BEFORE MACHINING...

with this Biltrite qualifying machine that checks block castings immediately after pressure testing and just before they start through the line. Set up with a master that establishes the exact amount of machining stock the castings should have, this machine checks cylinder bores, main bearing dimensions, several points at the ends and other surfaces. Spring-loaded plungers contact these surfaces and actuate limit switches that control color-coded paint sprays if stock allowance is out of limits. Color code identifies operation affected so that tooling adjustments can be made quickly when the block reaches that point in the line. Beyond specified limits, blocks are automatically rejected and returned to the foundry. Eight angular heads contain electrically operated followers for checking cylinder bores while axial centralizing is performed by a tapered plunger that engages a water jacket hole used later for locating purposes. Lugs at the sides and pads at the ends establish location of the block in the machine in these directions

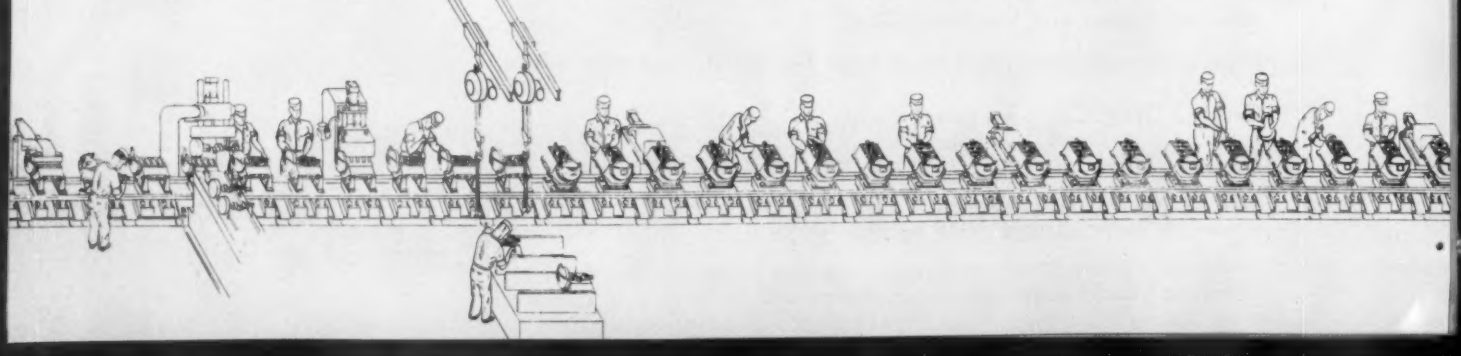
Engine designers and process engineers worked together in simultaneously developing Plymouth's new V-8 engine and the means of producing it. The usual lead time of 6 to 8 months for engine design alone was gained immediately by using the old engine as a prototype so that processing could start concurrently with the design of the new engine. Something of a record was established in the industry by making only 4 design changes in the engine as the result of processing from the start to the end of the program.

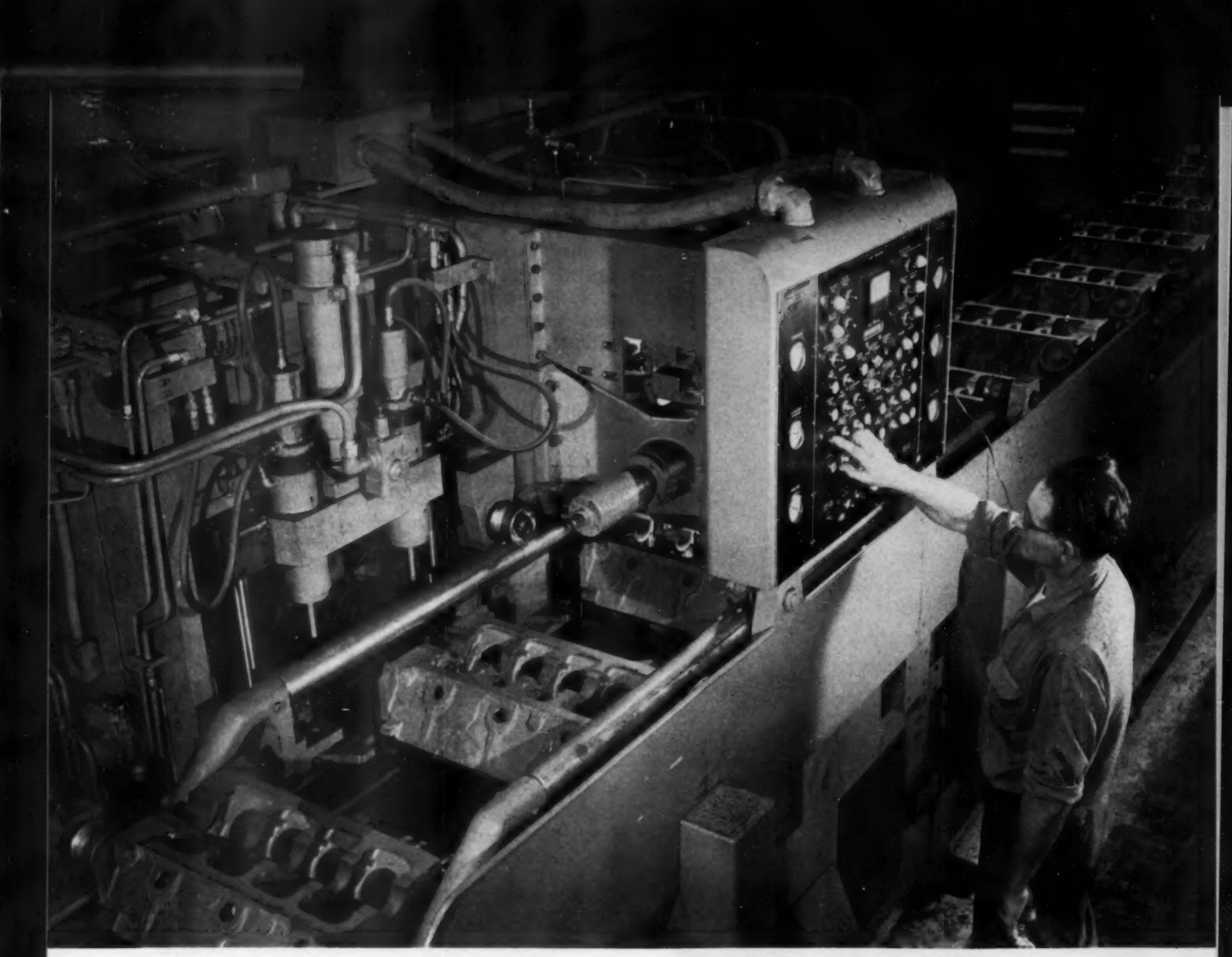
Current demand for V-8 engines placed a premium on time. Despite the fact that a project of this scope usually takes 2½ to 3 years to accomplish, a target of 12 months was set up—with completion to be achieved in 14. Target dates for engine production started Aug. 1 to reach 50 per hour by August 15, 100 per hour by Oct. 1 and 150 per hour by Nov. 15 when four head lines and two block lines with their associated component lines will be in full production.

Target dates to meet this production schedule—were established on the basis of the longest time required for delivery of equipment needed on major automated lines. Similar target date sheets were set up for other engine components and a master target date sheet for the whole plant was developed on the basis of the longest delivery requirement. In this way, close control was maintained over procurement, scheduled arrival, and installation of equipment.

UNIQUE SUPPLIER RELATIONSHIP

Suppliers operated, in effect, as divisions of the Corporation, being completely responsible for various portions of the lines whether they normally built all the equipment involved or not. For example, a machine tool builder given the job of supplying cylinder boring equipment also supplied the automatic gaging equipment needed in his machine to meet Plymouth specifications. This, of course, meant sub-





LARGEST BROACH IN THE WORLD . . .

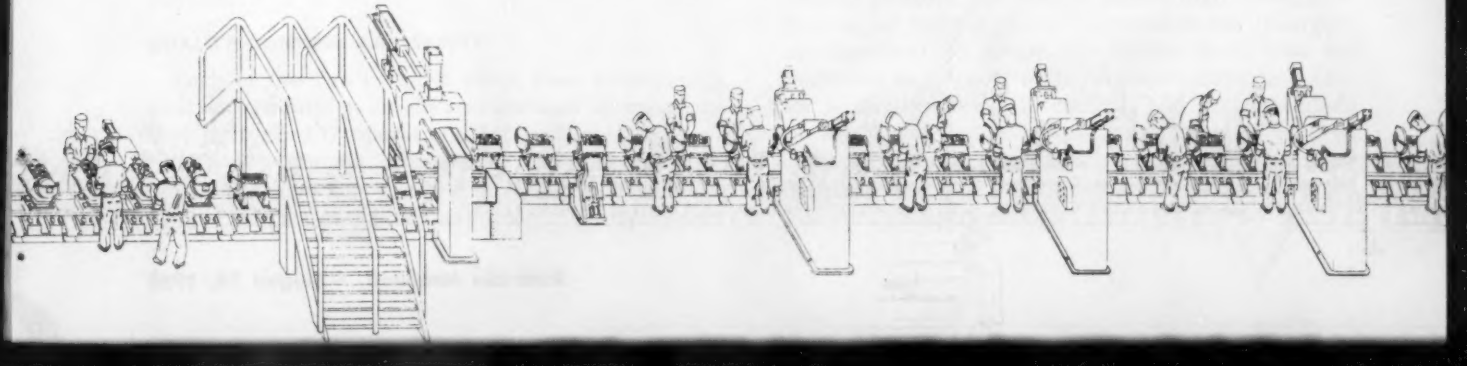
is reported to be this Cincinnati at the start of the block line. Single stroke of the machine in two stations broaches side transfer rails, bearing dia, bearing cap surfaces, right and left bank faces, lugs and intake manifold face. Blocks are transferred from first station to a turn-over fixture where chips are removed—then move on to second station. Ends of blocks are broached in a second 2-station Cincinnati machine after being turned around and gravity fed from this one although current practice in the industry is to mill the ends. This departure is to gain increased tool life because broaches are not in continuous engagement with work as are milling cutters. Maintaining uniform machining stock by means of closer than standard tolerances on castings overcomes usual broaching problems—in addition, the machine ram is 4 feet longer than required as insurance against downtime and to permit as much as 1/16-inch extra stock allowance if necessary. Mechanical drive on these and other broaches on the head, block, and other lines eliminates hydraulic surge—prevents tool breakage. Plymouth has found output to be about 20 per cent higher by this means as compared with milling

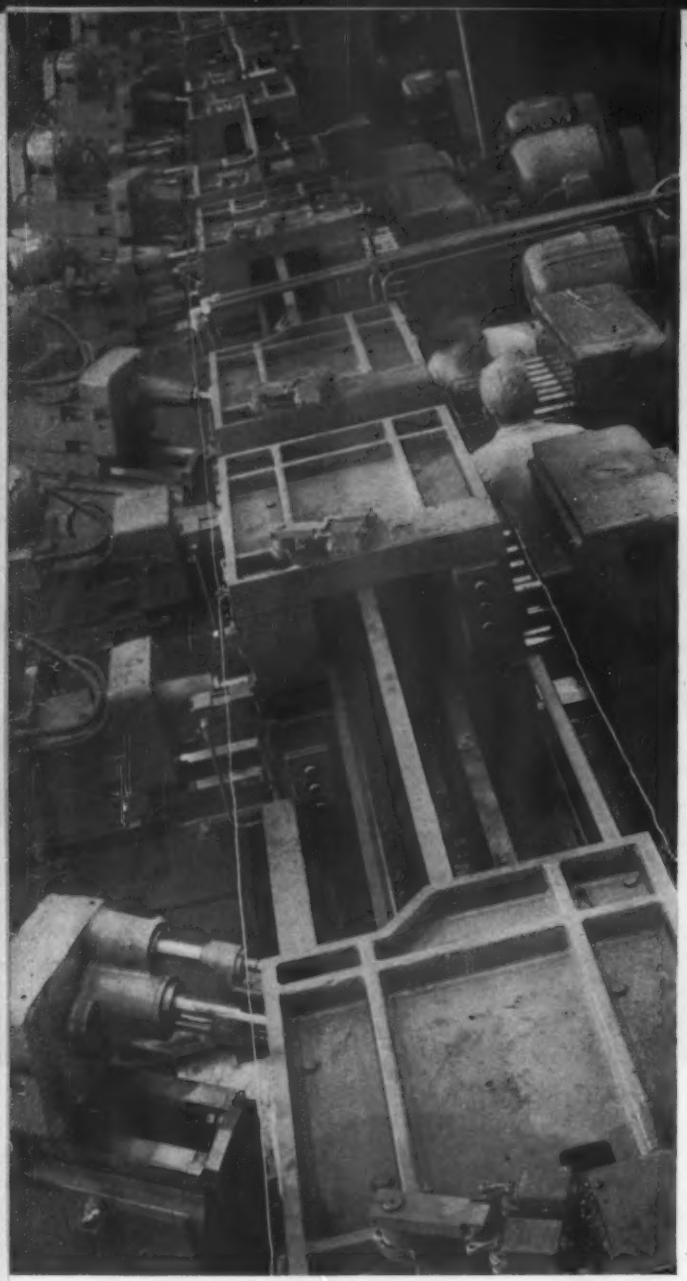
contracting that end of the job while assuming responsibility for quality, delivery and engineering. Another supplier was completely responsible for all cutting tools while still another was required to deliver all the air and electrical gages. Plymouth engineers kept complete control over all processing, however, and did not accept machine designs merely because they had previously been developed for other recently built engine plants. Over 1,100 quotations were reviewed in selecting machine tool suppliers who were ultimately chosen on the basis of their ability to deliver high quality, well engineered equipment, on schedule rather than on the basis of price alone.

STANDARDIZATION IMPORTANT

All switches, fuses, control cabinets, hydraulic units, electric motors, portable tools and everything else possible have been standardized. In addition to

COMBINING MANPOWER WITH AUTOMATION in engine assembly, this 560-ft block-assembly line sets a new standard. Sections of the line appear as page-foot decorations





HORIZONTAL SPINDLES . . .

and hardened and ground steel ways, (to avoid damage caused by trapped chips) are standard on all transfer machines in this plant—as are Cross tool control boards and Quality Engineering and Mfg tool holding boards. Wherever possible, blocks are processed through on sides rather than pan rail or cylinder faces as in other plants—to take advantage of rigidity gained with horizontal spindles. Distributor and oil pump holes are drilled and tapped in this Greenlee machine which, like others where holes are produced, is equipped with automatic probing stations between drilling, reaming and tapping stations to check holes for depth and reveal broken tools. Built-in Sheffield gages in these machines insure a high degree of accuracy before they pass on to the next operations

cutting inventories of small parts, maintenance problems are greatly reduced. Electricians work with only one type of equipment, cutter grinders become accustomed to maintaining certain types of tools and machine repairmen learn to know a particular line of hydraulic equipment. Moreover, purchasing such parts from single sources permits buying in larger quantities—provides higher quantity discounts.

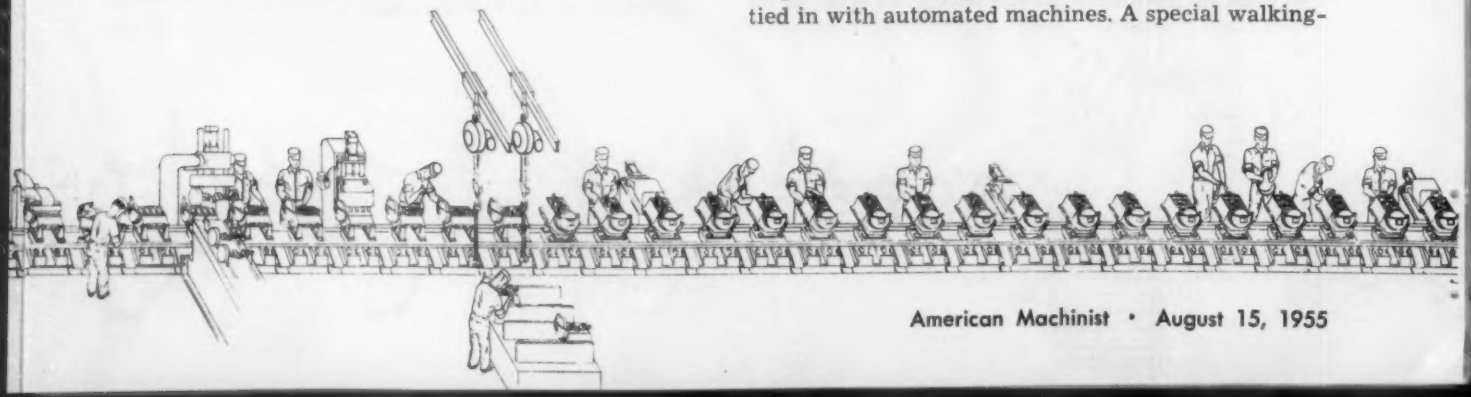
Another form of standardization is the specification that all machines have individual bases so that units of the same type can easily be interchanged. This also permits replacement of the working portion of a machine alone, when necessary. For similar reasons, only two types of ways are used throughout the entire block line—and all machines are equally spaced to facilitate removal and replacement. To simplify cleaning and plant housekeeping in general, operators at many setups stand on slightly elevated grates and all hydraulic units are raised for the same purpose.

Wesson inserted carbide milling cutters with as many blades as possible in the bodies are standard in the plant, too. Fine and coarse pitch "Rigidcut" tools are interchangeable, (with slight modifications in cutting angles) on any line. With special chip breakers on all tooling to maintain chip size, no crushers are needed in this plant—another departure from conventional practice.

HORIZONTAL SPINDLES PREFERRED

One of the most significant innovations in standardization is the use of horizontal spindle machines wherever possible. Development of "flat" lines—where these machines are employed instead of the vertical spindle type—was based on the advantages of greater accessibility for tool changes and greater rigidity because of the larger area supported directly on the floor. In all machines, emphasis was placed on heavy spindles—even where hole spacing made it necessary to rearrange heads to provide room for them. Evidence of the close liaison between engine designers, process engineers and machine builders is seen in the fact that all holes in the engine are spaced a minimum of 1⅞ in. apart to allow for husky spindle construction.

Materials handling is so completely conveyorized that only 6 industrial shop trucks are required in the entire plant—and these are reserved for maintenance use. There are over 14,000 feet of overhead conveyors in the machining and assembly areas and belt conveyors are used extensively on such lines as piston machining and assembly where they are tied in with automated machines. A special walking-



beam "make-up" conveyor on the crankshaft line is unique in the industry. Machine tool builders in some instances included shuttle conveyors from their equipment to 30 washers in the plant and many of these washers are equipped with special integral conveying and indexing devices.

An exhaust system of 61 collectors is employed in the CI machining area alone—each having a capacity of 10,000 cfm. These are part of a unique "downdraft" system which forces dust downward with the chips, unlike conventional setups where machining dust is drawn upward into overhead duct work. Besides keeping the air clean, this system cuts maintenance costs by eliminating dirt on and around machines. This installation takes the dust and the chips through the bottom of the machines into underfloor drag conveyors that carry them into a transverse distributing conveyor at the end of each line. These conveyors transport the load to storage hoppers of 120 tons capacity outside the building from which the chips go into railroad gondola cars. About 8 tons of CI chips and dust are handled in this manner each hour—the load coming from head and block lines, bearing cap, intake and exhaust manifold, oil pump body and the chain case cover lines. Link-Belt underfloor conveyors for chip disposal are controlled at panels on which the system is diagrammed.

Steel chips are removed at a rate of 2 tons per hour from 13 bays of equipment through a system of velocity trenches under the machines. Water soluble coolant is pumped through these trenches at 5,000 gpm to wash the chips into a 40,000 gallon tank where a 7 min settling period is provided. Smaller settling tanks have also been installed for other machining and grinding lines. For example, the rocker arm line has a system with a 1,000 gpm pumping capacity to run chips into a 7,000 gallon tank, and a portion of the crankshaft machining line has a 650 gpm system to a 4,550 gallon tank. For crankshaft and camshaft lapping, pressure filters handle chips and coolant and return the coolant filtered down to about 10 microns. Of course, numerous machines are equipped with individual filtering systems and both wet and dry aluminum chips are handled in a separate installation of velocity trenches at a rate of 400 pounds per hour.

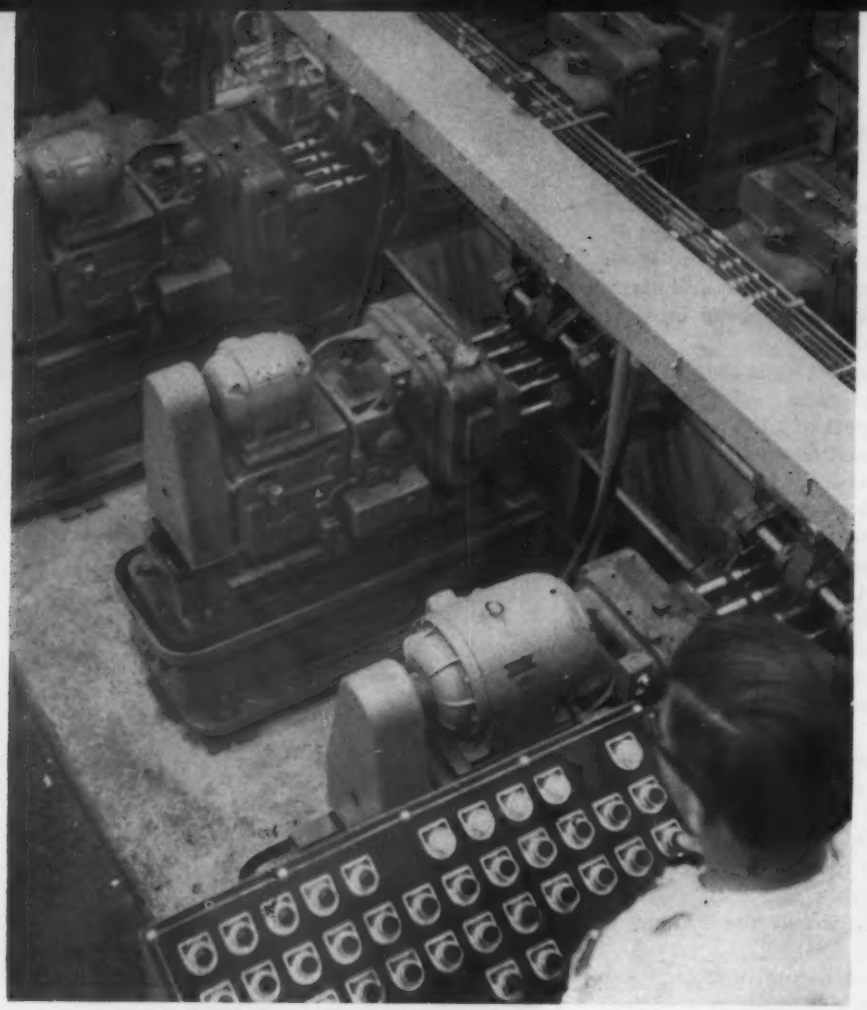
Hundreds of miles of electrical wire have been installed in this 530,000 sq ft plant—with 500,000 feet of it going into the automatic final assembly line alone. Power concentration here is exceptionally high—there being over 28,000 hp connected to run machines, conveyors and automatic handling devices.

"DETECTO" PANELS PAID FOR THEMSELVES . . .

during try out period alone by saving time of maintenance crew. Printed test circuit on these W F and John Barnes devices on bridges over the head and block lines operate on 110 volt circuit connected to relays on the machines to control 440-volt line circuit. Holes in the panels are contact points which operator engages with a "pencil" to excite an indicating light at the machine. By thus probing when trouble occurs in the line, the exact location of faulty relays, limit switches, or other devices is quickly and accurately determined

QUALITY CONTROL AND SAFETY

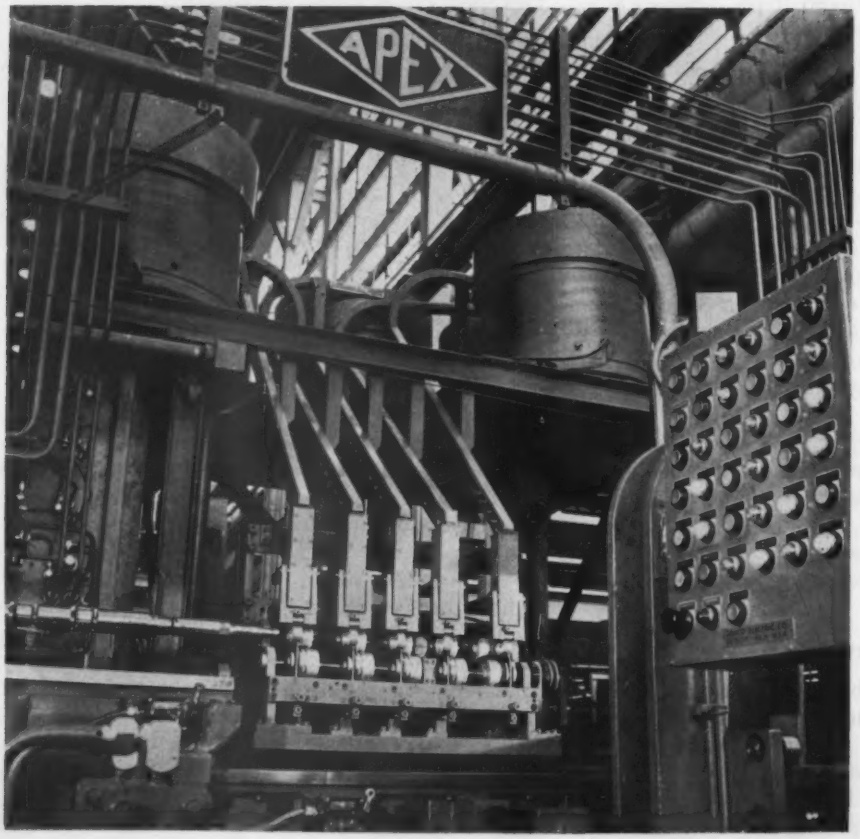
Each of the two cylinder block lines runs over a quarter of a mile in length and contains 70 machines that perform 157 operations not including 3 separate washes during processing. The four cylinder head lines are each 400 feet in length and perform 67 operations and the half mile long crankshaft lines includes 70 machines with special automation. These and the machines on other lines are completely equipped with safety devices as well as automatic inspection units at critical points. Quality control is emphasized in this plant not only to achieve a quality product, but also to insure high speed production by cutting rejects and repairs and is largely accomplished by automatic devices built into the machines as integral units. Another important factor is starting out with castings and forgings made to tolerances much closer than those considered standard in conventional foundry practice and automatically inspecting each one completely before the first machining operation.



Plymouth puts

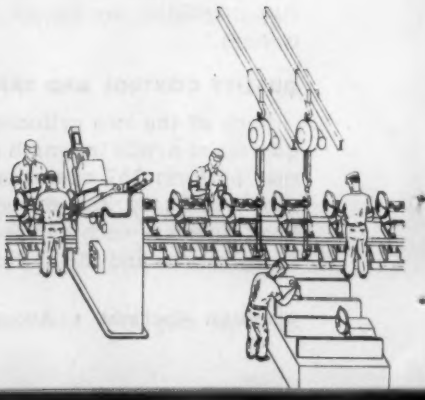
ONE OPERATOR CONTROLS TWO LINES . . .

of transfer machines by means of two consoles and a loudspeaker on a bridge over the lines. Both head and block lines are equipped in this manner so that an operator—who can see every machine in his lines from this vantage point—can transfer parts from one line to another when a machine in either is down or tools are being changed. Besides switching parts back and forth from one line to another, he can store, or bank, parts until a line is ready to use them

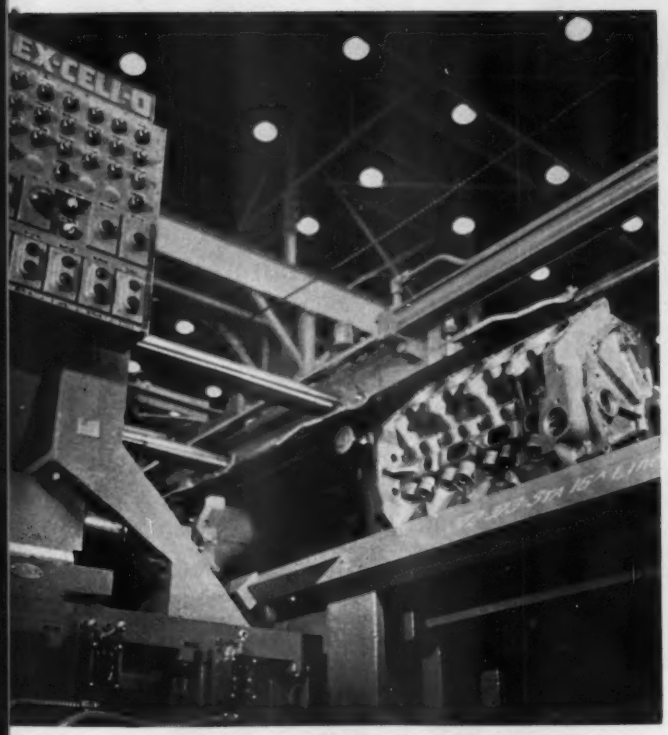


CAMSHAFT BUSHINGS ARE AUTOMATICALLY LOADED . . .

on mandrels for installation in blocks in proper position—that is, with oil holes in bushing aligned with those in the block. This Apex machine with vibratory hopper feeders that automatically deliver 5 different size bushings to the mandrel, is one of many specially built for Plymouth to automate an operation done manually in other plants

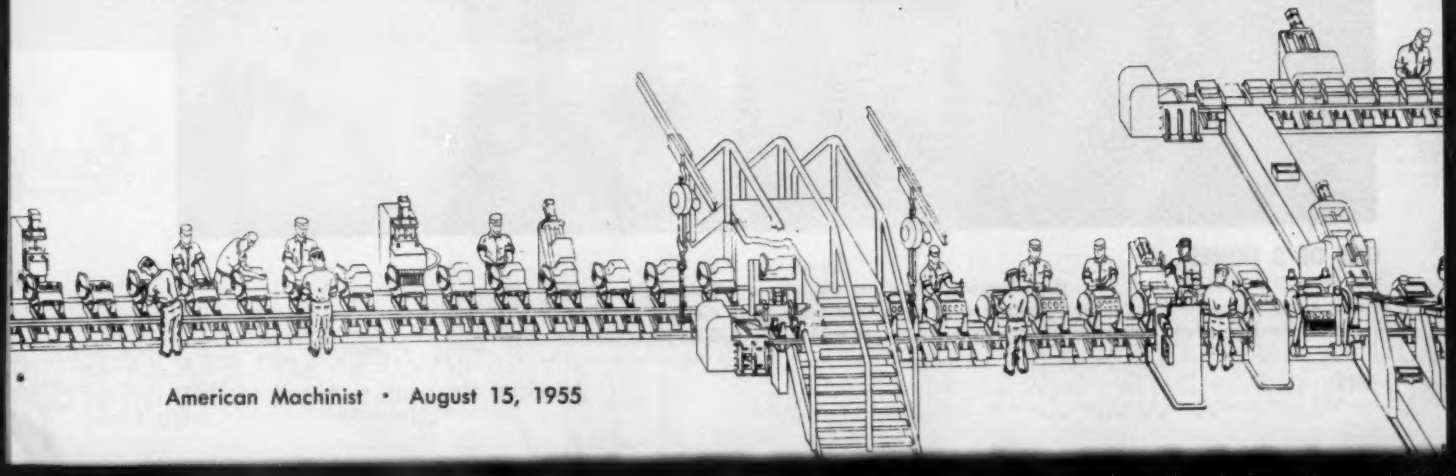


'FORWARD LOOK' into V8 production

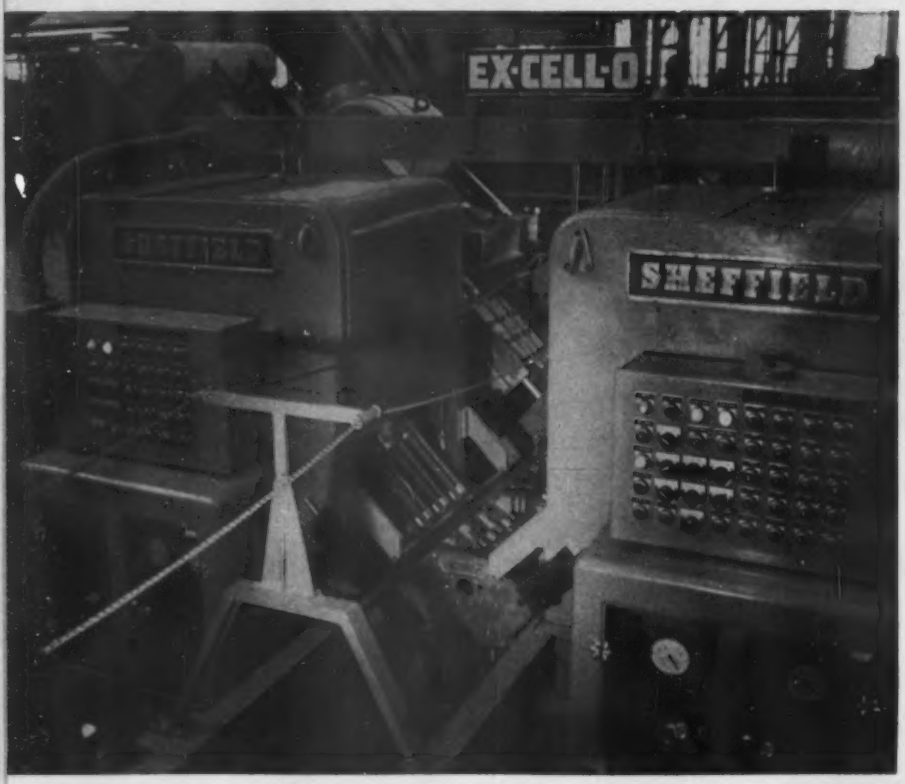


AUTOMATION, AUTOMATIC INSPECTION . . .
and 4-way boring and milling are combined to speed operations on engine blocks after bushings have been installed. In this Ex-Cell-O machine, bushings are finish bored simultaneously with crankshaft holes and others. Work is automatically transferred from Apex machine into this one, conveyed through multiple operations and then inspected before being conveyed to the next machine. Here again block is positioned to permit use of large dia horizontal spindles

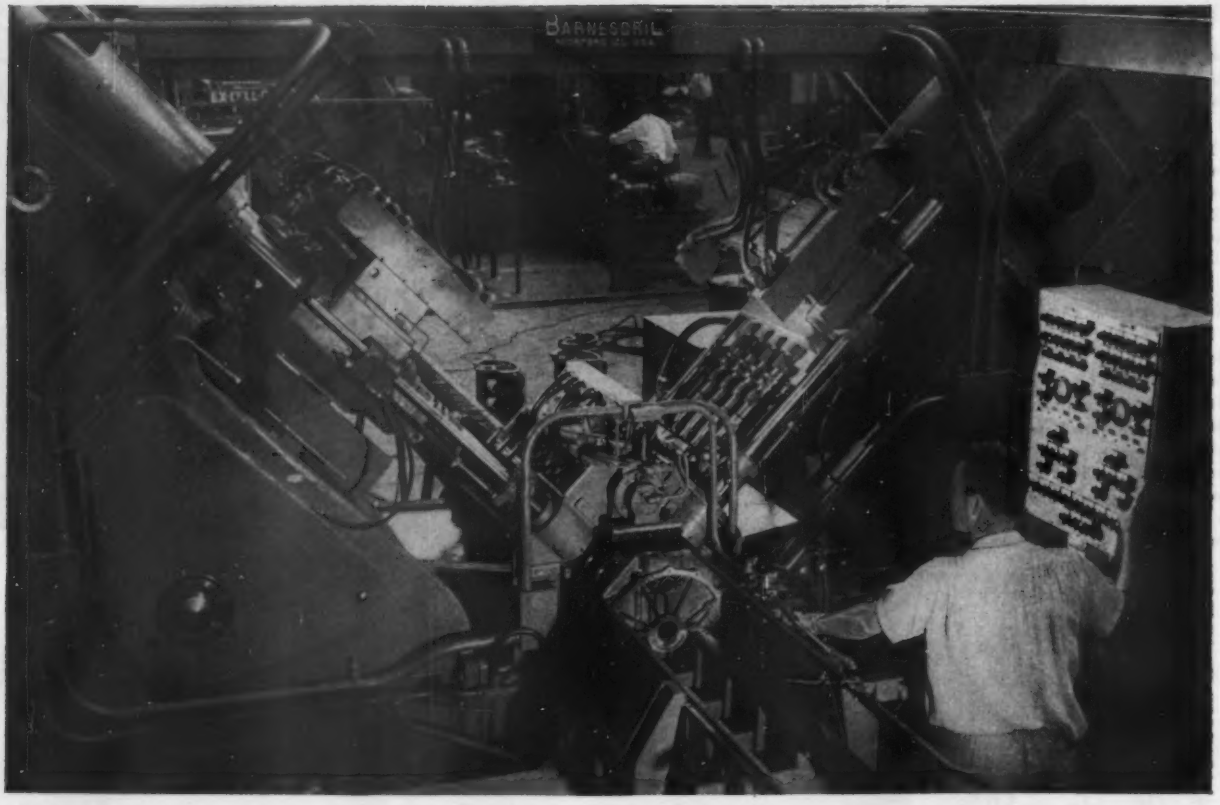
LARGE SPINDLE BEARINGS . . .
in Ex-Cell-O machine for semi-finished boring 8 valve tappet holes are typical of most machines in this plant. To accomplish this rugged spindle design in operations where close center distance of holes normally necessitate light spindles, every other hole is bored on each side so that a total of 4 are machined at once—two on each side. Second index of block in the machine takes care of remaining 4 holes. Emphasis on heavy spindle designs is to provide large bearings for shock loads and other conditions common to multiple spindle operations



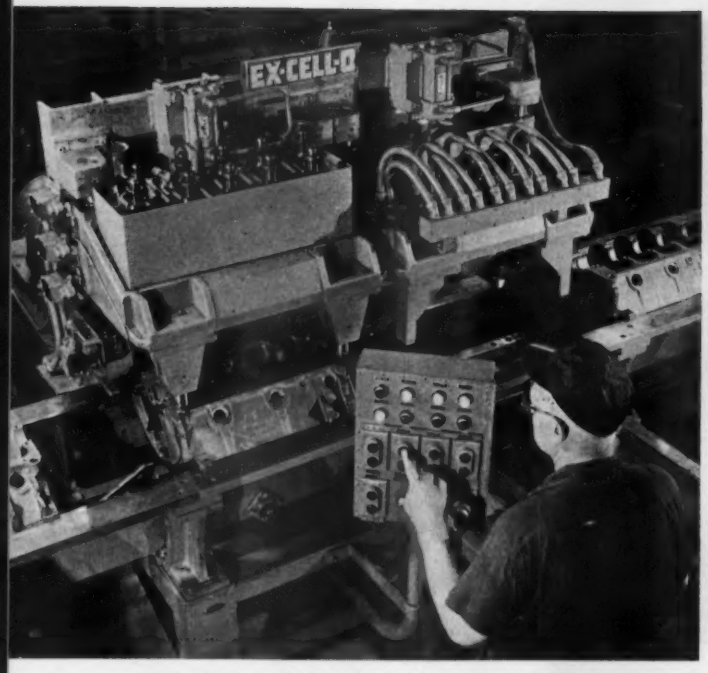
Plymouth puts 'FORWARD LOOK' into V8 production



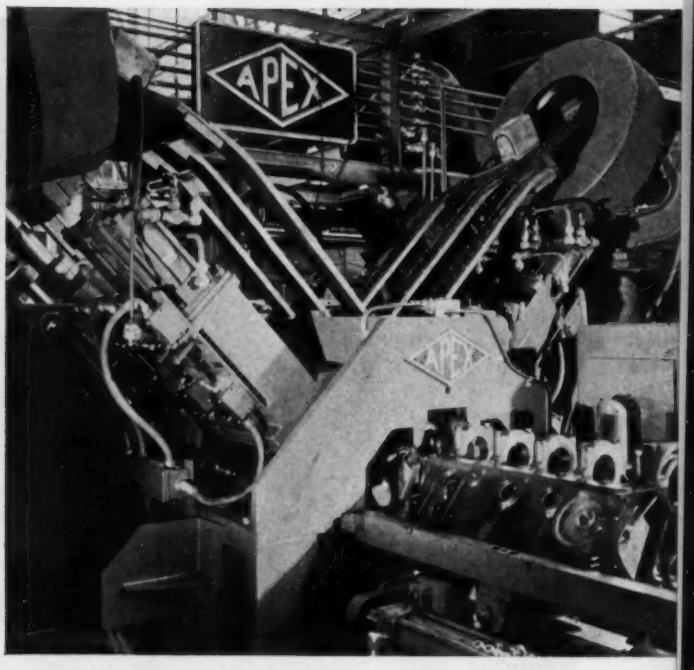
CYLINDER BORES ARE 100% INSPECTED . . .
after finish boring in this Ex-Cell-O machine with built-in Sheffield "Lectrolair" gages. This cuts size variations to a minimum, reduces selective fitting of pistons. Gage checks undersize, oversize and in-limit dimensions—stops machine for oversize parts and rejects them—runs undersize bores through again. Color-coded lights indicate tool settings required. Eight bores are finished simultaneously with single-point carbide cutters in 4 spindles on each side. As in most other machines in the plant, these tools are held in magazines that permit presetting to avoid adjustments at the machine



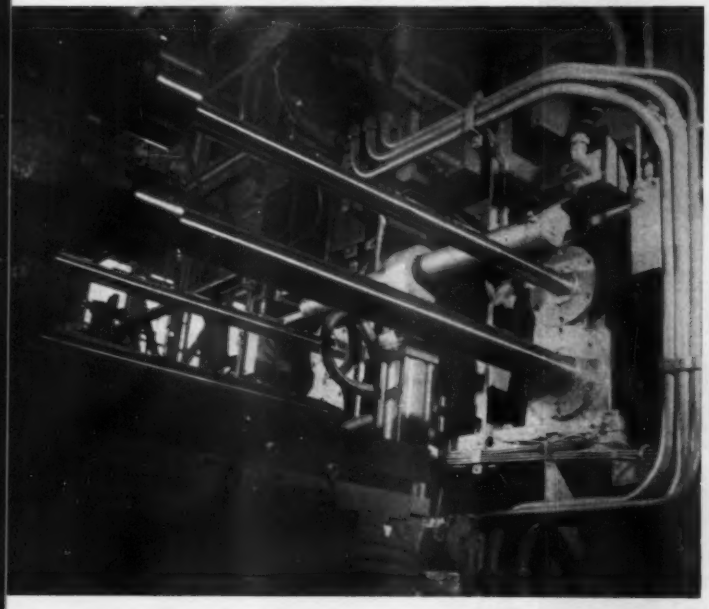
ONE OF 3 HONES . . .
that serve 2 automated block lines, these Barnesdril machines finish hone cylinder bores. Blocks visible in the background are in an inspection area established adjacent to the line to simplify in-process checking. Blocks with undersize bores are readily returned to the machine for repair run



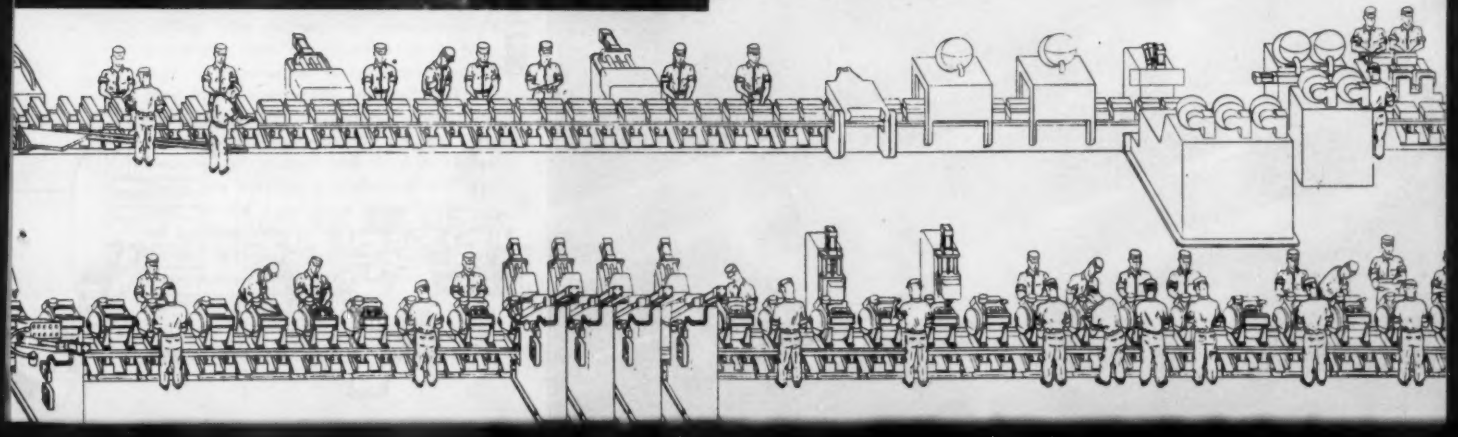
AUTOMATIC TORQUING AND TIGHTENING...
bearing capscrews are handled in this Ex-Cell-O machine where screws are also gaged to be sure they are properly secured—automatically rejected if not. Conveyors carry work through the machine from the only manual operation on the block line—that of positioning bearing caps and screws prior to operation



FAST ACCURATE ASSEMBLY OF WELCH PLUGS...
and dowels in cylinder blocks is automatic in this Apex machine. One of two vibratory hoppers feeds plugs to a collet that enters the block and pauses until a plunger inside the collet pushes the plug into position. Block is then indexed to a spinning head where ends of plugs are rolled to form a good seal—an extra operation not found in conventional setups. Second Detroit Power Screwdriver vibratory feeder delivers dowels to the machine for assembly in front and rear faces

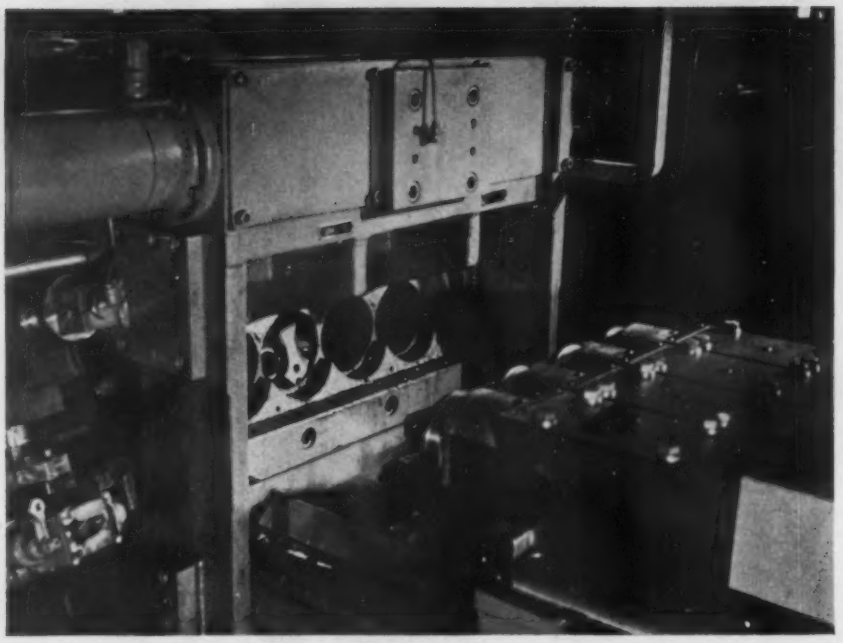


HOLE-ALIGNMENT PROBLEMS ARE SOLVED . . .
by line boring two blocks at a time in this Ex-Cell-O machine. Normally, machining numerous holes at various stations in different machines makes accurate relationships difficult. All holes must be aligned within close tolerances. In this setup, camshaft and crankshaft holes are rough-bored with the block held in one position to eliminate indexing and turning. Large spindle bearings provide a high degree of accuracy, cut chatter, increase tool life and reduce maintenance. Here, too, inspection is automatic by means of a built-in Sheffield gage

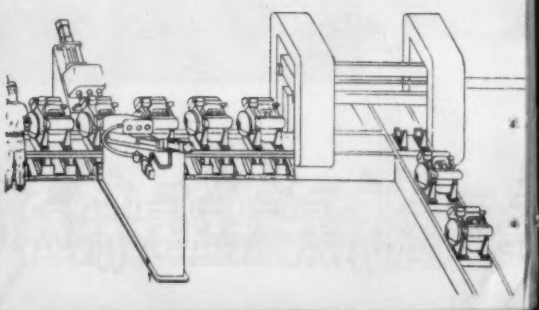


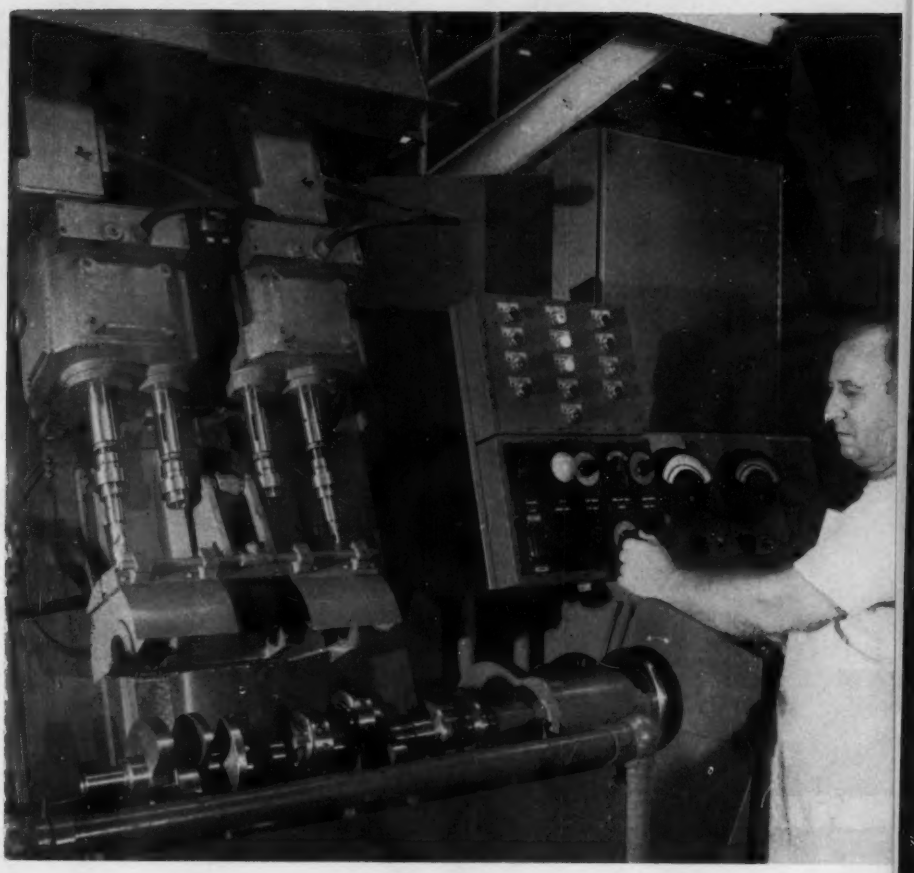
Plymouth puts 'FORWARD LOOK' into V8 production

TWO-IN-ONE HEADS . . .
on this W. F. and John Barnes transfer machine spot faces exhaust valve seats in cylinder heads with outer spindles while valve tappet holes are precision bored with inner spindles. Head is positioned on exhaust manifold face oriented at proper angle for the operation performed with carbide tools. Next station does intake valve holes in the same manner



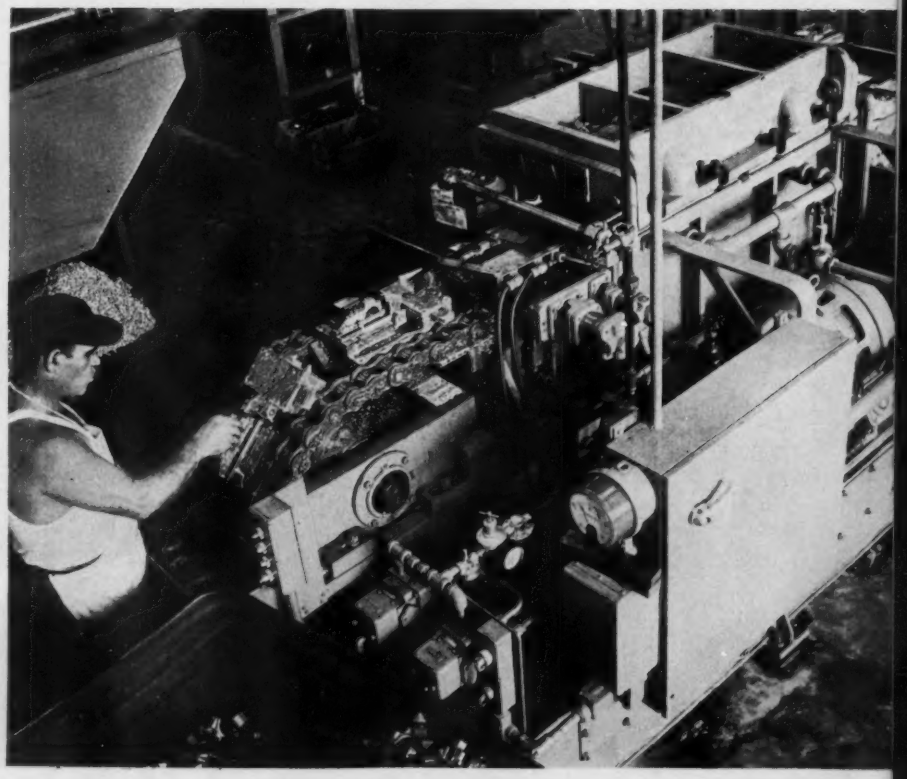
WALKING-BEAM CONVEYOR . . .
on crankshaft line serves these Fitchburg mills as well as LeBlond lathes, Wickes Brothers center drive lathes, and all other setups on the line. Unusual feature of conveyor system is "make-up" operation which never skips a station as is done in conventional banking or storage lines. Down machines are bypassed automatically as are those that are full—conveyor automatically finds an open machine and loads it. Made up of a main longitudinal conveyor with transverse infeed and outfeed portions, the entire system is built in 96 inch sections, each with its own independent electrical and hydraulic system for easy maintenance or quick replacement. Main longitudinal conveyor turns each crankshaft 180 degrees to position it for infeed conveyor that feeds automatic machine loader. After the machining cycle, work is unloaded automatically into outfeed conveyor that carries it back to the upper section of the longitudinal conveyor for transfer to the next operation. Fitchburg spot mill in background is first used in the automotive industry for this job—was specially designed for automatic unloading into walking beam conveyor





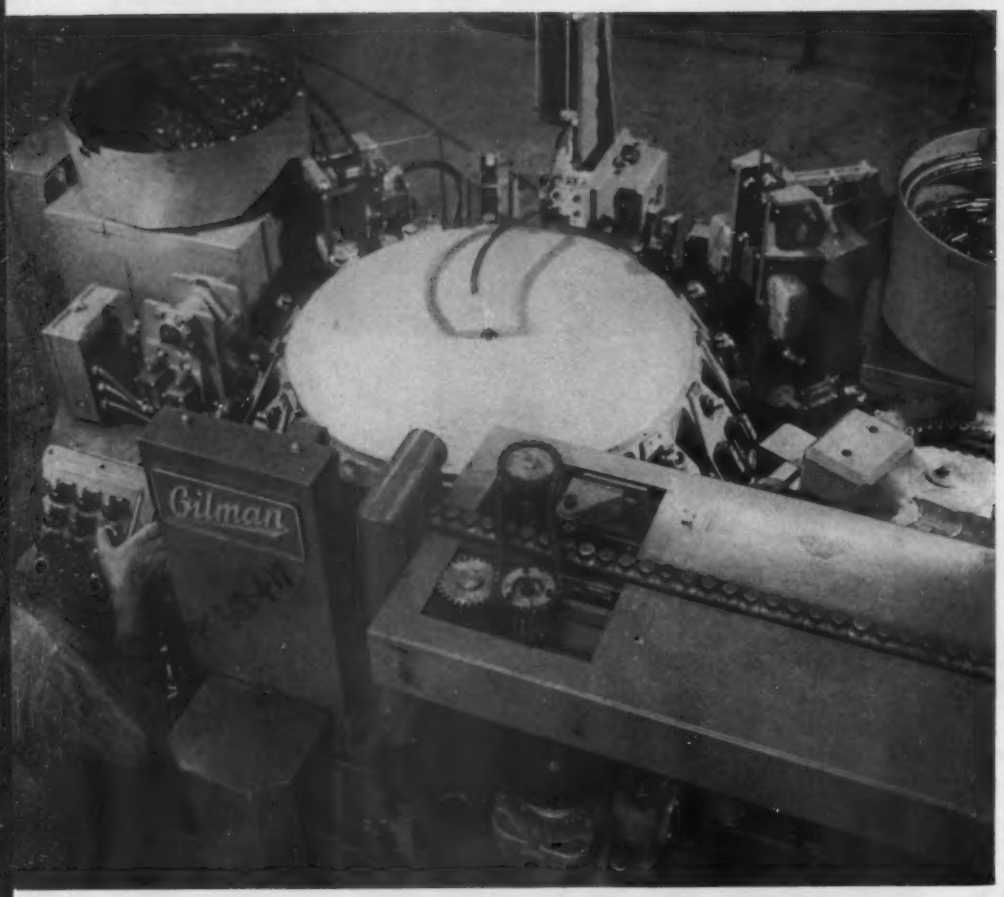
AUTOMATIC CRANKSHAFT BALANCING . . .

within 0.25 oz-in. is done in Tinius-Olsen machines like this one where operating load of pistons, connecting rods and other parts are simulated. Both right and left ends are checked as well as inner and outer counterweights while Weston "Electodyne" dials indicate angle at which out of balance occurs so that 1-inch and 7/16-inch drills can automatically remove stock from the correct quadrant. Machine can be set for manual operation, too, by means of an additional colored dial on the console which indicates quadrant from which stock should be removed



CONTINUOUS BROACHING . . .

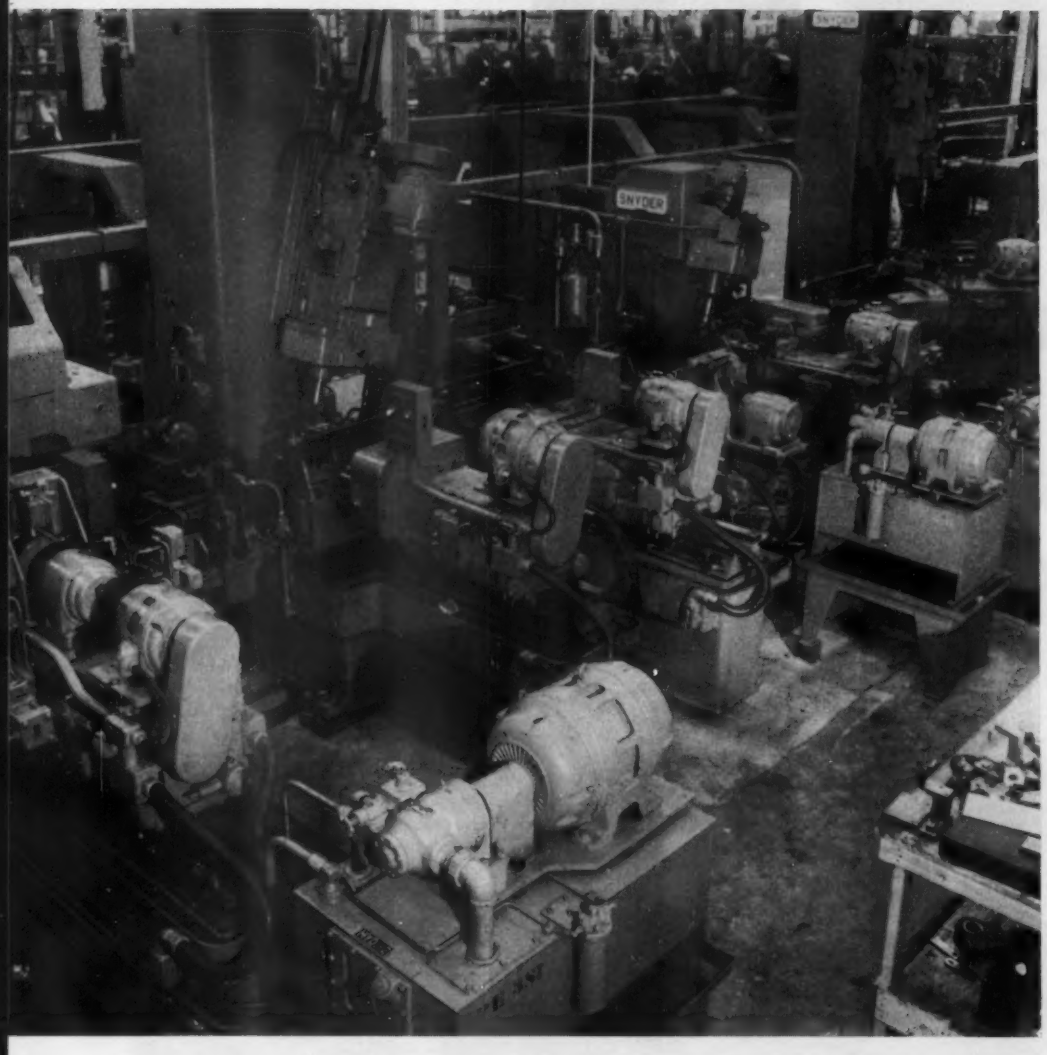
of connecting rod caps is handled by 3 Lapointe broaches, one operator, and automatic handling between machines. In this setup half-rounds and flat bearing surfaces are broached prior to grinding, drilling and delivery to connecting rod assembly. Here an operator loads forgings in fixtures at first machine where they are automatically clamped and carried through for the first operation. Ejection is automatic—as is loading and clamping at second and third machines. These are the first broaches of this type built for the automotive industry. To cut set up time, simplify cleaning and maintenance, Wesson "Dual-Wedg" locks are employed on these and all other broaches to hold inserts, or cutters



FIRST CONNECTING ROD ASSEMBLY MACHINE . . .
in the industry is this Gilman installation. Conveyor carries caps and rods into the machine where they are automatically loaded in fixtures on an indexing table—in proper relative positions. Bolts and nuts, (2 of each for each assembly) are delivered from vibratory hopper feeders, positioned automatically, and then run into full engagement

ROCKER ARM SCREW ASSEMBLY IS AUTOMATIC . . .
by means of this 2-station, double-indexing Bodine machine. Manually loaded rocker arms are placed on locating studs on indexing table for transfer to assembly spindles. Screws are fed to the table from Peeco vibratory hopper feeders—run into engagement with rocker arms at two rotary spindle heads and ejection is automatic at two stations. Located in miscellaneous assembly and supply area, this machine prepares rocker arms for delivery to automatic final assembly line on overhead conveyor system

'FORWARD LOOK' into V8 production

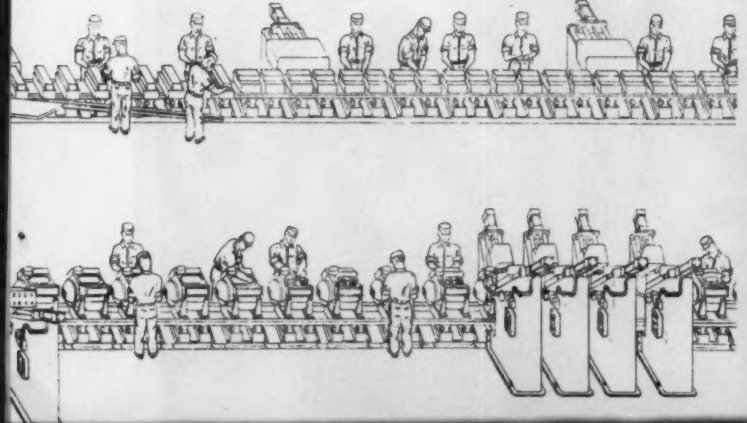


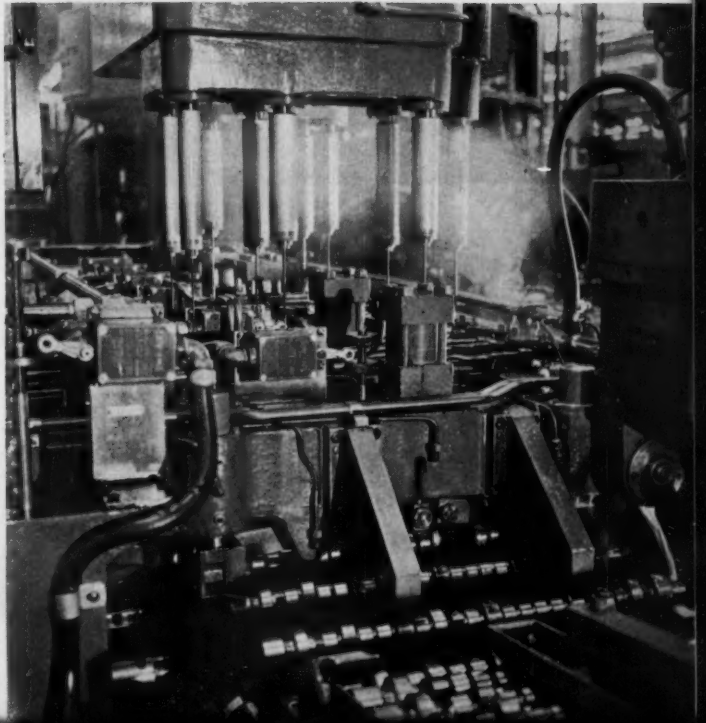
ONLY TRANSFER MACHINE . . .

for oil pump bodies in the industry is this 84-station Snyder unit that drills, reams, taps, bores, countersinks, counterbores, washes and inspects the parts. Speeds and feeds used here, as in all other machines, are relatively conservative—being more economical in the long run since they cut down time and increase tool life

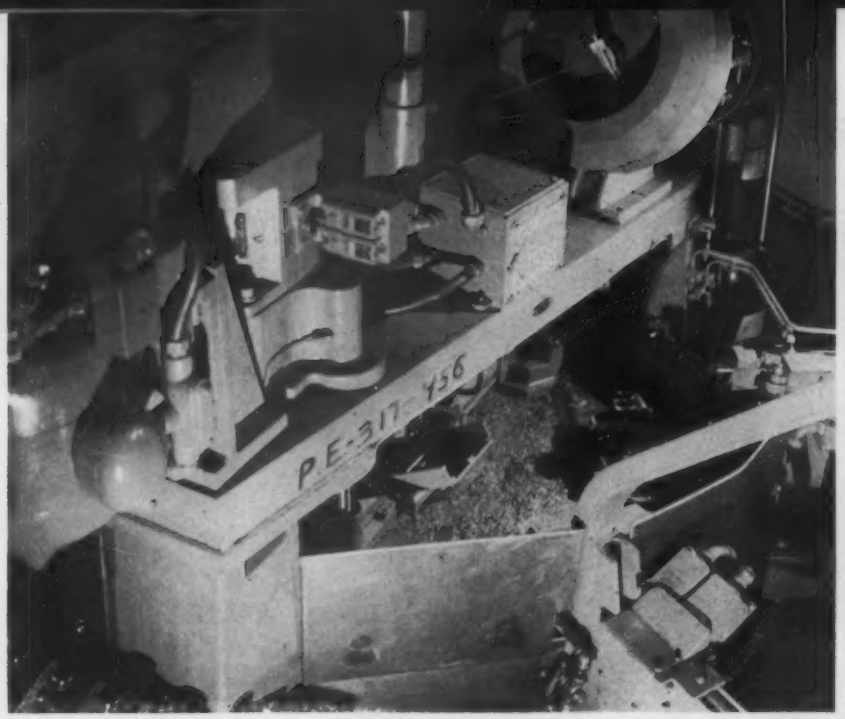
ONE OF FEW VERTICAL SPINDLE MACHINES . . .

this Kreuger-Barnes setup also has horizontal spindles. Oil holes in the bearings and ends of camshafts are produced as well as tapped holes, milled keyways, and spot facing. Work is automatically loaded—picked up on centers, oriented for alignment with cam lobe and held in position through all operations. Automatic ejection puts camshafts into a chute that transfers them to a Lees-Bradner hobber installed in a pit so that its operator can conveniently load it for hobbing the distributor gear at one end





Plymouth puts

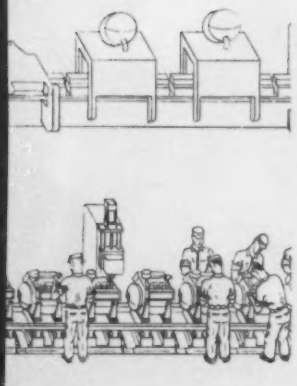


AUTOMATIC ASSEMBLY...

of oil pump rotor, shaft, and pin is handled in this Rehnberg-Jacobson machine by feeding all three components to assembly heads from vibratory hopper feeders. After being positioned in fixtures on an indexing table, the rotors and shafts are drilled and reamed before the pins are pressed in place to complete the assemblies

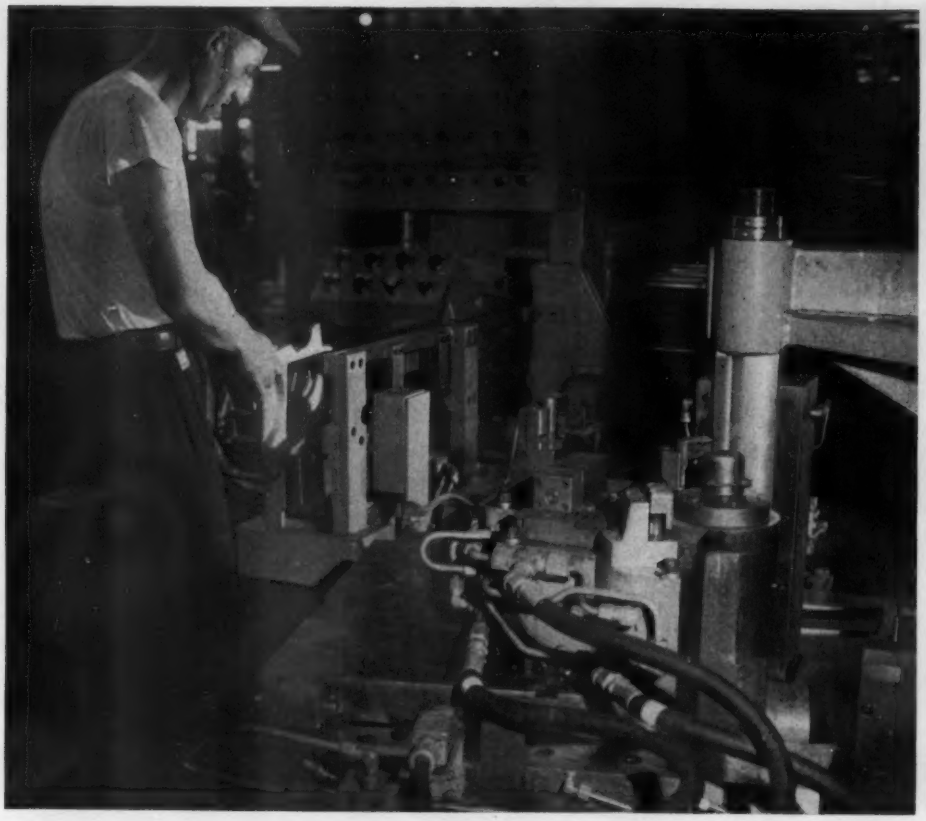
AUTOMATION ON A STANDARD MACHINE...

is provided in this 6-spindle Lees Bradner hobbing setup where helical distributor drive gears are produced. Blanks are delivered from a vibratory feeder to a double pick-up finger that loads one in the machine fixture after removing a finished gear. A hydraulic ram seats the blank in the fixture while the hobbed gear is dropped on a small belt conveyor for transfer to an automatic Airborne Laboratories checker. Here gears are checked for size and the hob spindles are automatically controlled to move in or out depending upon conditions found. This device also controls the position of the hobs to compensate for wear. Automatic ejection into chutes that deliver the gears to the next operation follows



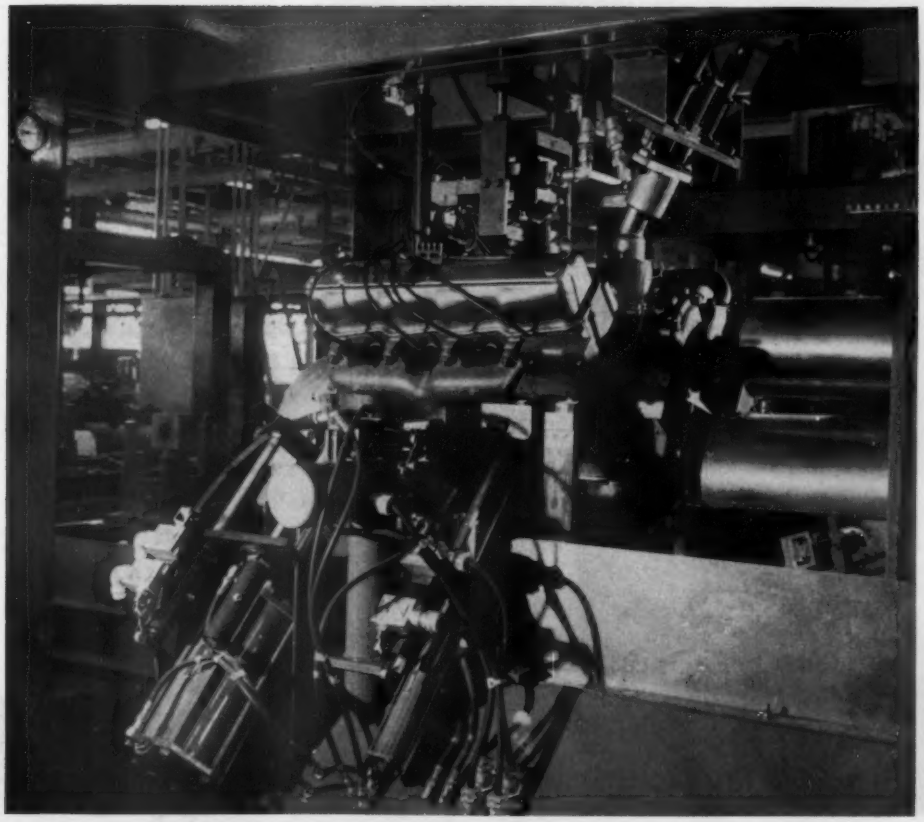
INGENIOUS HANDLING...

and simple tooling speed machining powdered metal oil pump rotor after assembly with shaft and pin. Assemblies are hopper fed to this Ex-Cell-O machine where a swinging pick-up arm removes one at a time from a chute and delivers it to a spindle. Here the rotor is rotated in engagement with single point carbide cutters that straddle the ends for a double facing operation. Automatic ejection into a chute follows



MANPOWER COMBINED WITH AUTOMATION . . .

is illustrated here where chain case covers are manually loaded into a fully automatic Snyder transfer machine for multiple operations, including washing and testing. Vertical 90-in. Lapointe broach immediately preceding it is installed in a pit to lower working area so that manual handling to the transfer machine is simplified



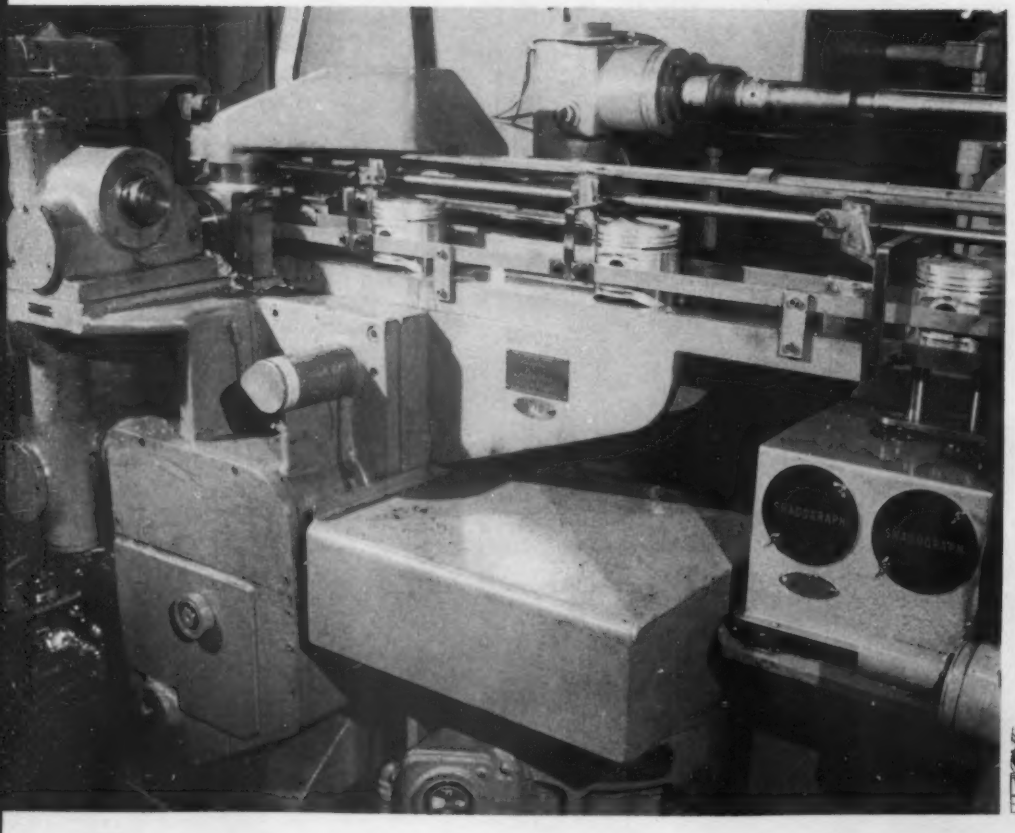
ENGINE RUN-IN TEST IS AUTOMATIC . . .

on Nankervis test stands where hydraulic devices automatically fill engines with oil, add carburetor (for test only), engage exhaust attachments and others in a predetermined order. Oil and water leaks and pressure are checked here along with tappet noise, while engines run for a 20-minute cycle — using natural gas instead of gasoline for easier and safer handling, economy, and to eliminate exhaust problems. Engines are delivered from final assembly line on overhead conveyors —are manually loaded onto conveyorized pallets that automatically locate empty test stands—by-pass those in use. After run-in is complete, indicating lights signal test results—show that units are ready for removal to pallet for transfer to overhead conveyor again. This conveys them to storage area ready for shipment

Plymouth puts 'FORWARD LOOK' into V8 production

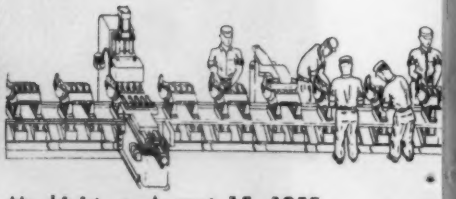
AUTOMATION ON THE PISTON LINE...

is complete with automatic gaging, conveyors, and automatic loading and unloading devices. Rough cast aluminum pistons are semi-finish turned, grooved, and faced in Baird machines before transfer to specially built 2-spindle Heald Borematics for producing smoke slots with HSS slitting saws. In the setup shown, wrist pin holes are bored, chamfered and undercut in a special Heald machine with a built-in Pratt & Whitney air gage. Next, valve clearance slots in the piston dome are milled, followed by finish boring pin holes in other Heald machines. Cincinnati centerless grinders are employed for skirt grinding after which the parts are delivered to a special automatic Stevens tin plating unit. In all cases, pistons are conveyed, loaded, unloaded, gaged, and transferred automatically



PRE-MACHINING PISTONS...

at first station simplifies and speeds Morris weight mill operation where the parts are brought to exact weight required for balance in engine operation. Second station automatically weighs them and sets milling cutter for required amount of stock removal. A final check is made for weight before pistons are automatically ejected.



American Machinist SPECIAL REPORT NUMBER 401

HOW TO WORK

Titanium and its alloys ...

ANDERSON ASHBURN, special project editor

Never has the development of a new structural metal developed as rapidly as has titanium. Blessed with a high strength-weight ratio, corrosion resistance, and plentiful ores and initially holding promise of high-temperature resistance, titanium looked so essential to the supersonic era that both research and production were heavily subsidized.

Initially, as many predicted, there was too much optimism. In contrast, as the inevitable problems arose, there has sometimes been too much pessimism.

There can be no question that titanium has a sound future both as a strategic material and a commercial material for specialized uses.

Many of its problems have been solved and the techniques for working it are far less tentative than they were when *American Machinist* published its first Special Report in 1951.

Here is a comprehensive summary of where titanium stands today, in production and use, the properties that can be expected, and the current practice in heat treating, machining, forming, casting, welding, cleaning, and finishing.

Further improvement in both the metal and the methods of working it can be expected. As in the past, such improvements will be reported in *American Machinist* regularly.

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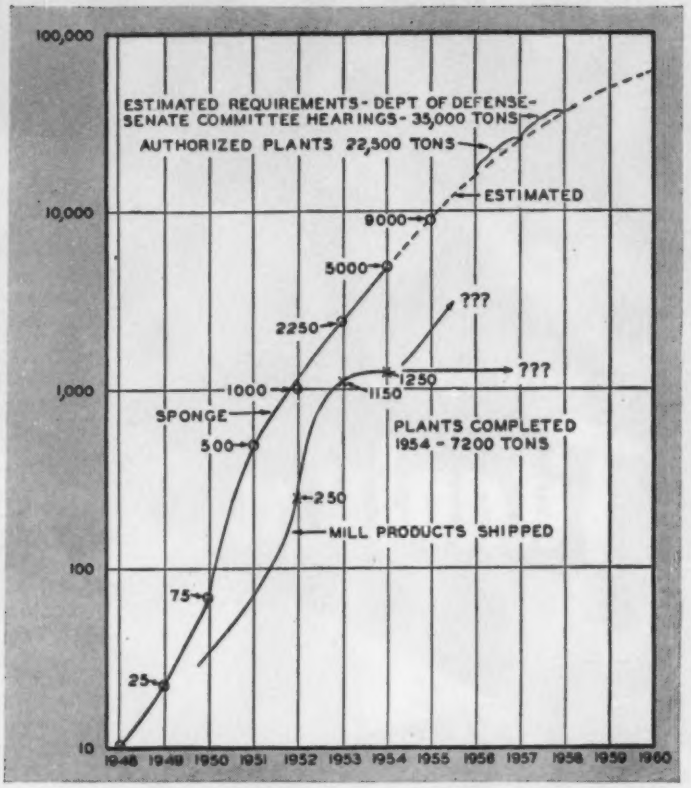
Titanium today



Raw titanium sponge is now being reduced from ore by du Pont and Titanium Metals Corp. Total production in 1954 was about 5000 tons. Production of sponge this year is expected to run about 9000 tons, with Cramet and Dow beginning to add to the output.

Goals for sponge are 15,200 tons in 1956 and 22,500 tons in 1957. Electro Metallurgical Div of UCC is building a large plant. Horizons Titanium has a research contract with the government for a small electrolytic plant. Kennecott Copper is planning a small plant. The General Services Administration, which has developed this capacity through purchase contracts, has under negotiation several other contracts.

Mill product shipments in 1954 were about 1250 tons (compared with the 5000 tons of sponge production). Four major concerns are now melting sponge and producing titanium and titanium alloys. They are Titanium Metals Corp, Rem-Cru Titanium, Mallory-Sharon Titanium, and Republic Steel.

Oversupply of titanium in 1954, resulting from the sudden jump in sponge production and lagging orders, can be traced to four factors:

1. Still not enough production for any major application
2. Technical difficulties in producing and working
3. Disappointment with present design properties
4. High cost

Progress is being made in reducing all of these problems. The purity of sponge varies over a wide range. Metal producers have developed elaborate systems for analyzing and blending sponge to produce more consistent compositions from heat to heat.

Improvements in melting practice and processing have reduced the contamination from hydrogen, oxygen, and nitrogen. All suppliers now offer titanium with less than 0.1% carbon. Excessive variation in mechanical properties still plagues the titanium user, but obvious progress has been made.

In sheet flatness, for example, Rem-Cru reports that the percentage of sheets of A-70 having flatness within 2% increased from about 44% in 1953 to 77% in 1954.

The desirable strength-weight ratio that was the basic reason for turning to titanium initially has been at least partially realized in the alloys now available. But the high-temperature properties expected from a material with a melting point so high have not, and there have been other disapponitments.

Experimental alloys show promise of better design properties and intensive alloy investigations are continuing. Alloys that possess better stiffness, higher hot strength, and weldability, among other properties, can be expected.

Finally, as to cost: Present base prices per pound run about $9 for billets, $12 for bars, and $15 for sheet. Although the complex nature of the process for producing titanium holds little hope that the price will ever be as low as that of the common structural materials, some producers have estimated that, with what is now known about production, the price of these products should be cut in half in the next few years if demand for mill products reaches a level of 10,000 to 20,000 tons.

Properties of titanium

Titanium is a light metal. Although 60% heavier than aluminum, it is only 56% as heavy as alloy steel. Touched with a grinding wheel, it produces an intense white spark stream ending in brilliant white bursts—a ready identification. Another method is to moisten and rub on glass, where it will leave a gray-white mark.

Pure titanium is difficult to obtain and is used primarily in laboratory research. A soft, ductile metal, it has a yield strength of 15,000 psi, ultimate tensile strength of 80,000 psi, and elongation of 55%. The melting point is 3020 F.

These properties are not likely to be encountered outside the laboratory, for titanium combines readily with all chemically active gases at high temperatures, and in the molten state reacts with every known refractory material.

COMMERCIALLY PURE TITANIUM

Properties of commercially pure titanium vary somewhat, but all are considerably stronger and less ductile than pure titanium. Typical properties of available grades are shown in the table. *In the remainder of this report the word titanium will always refer to commercially pure titanium, as distinguished from titanium alloys.*

Titanium does not respond to heat-treatment, but may be cold-worked to tensile strengths in excess of 120,000 psi, with yield strength of 100,000 psi, and a drop in elongation to about 12%.

TITANIUM ALLOYS

Composition and properties of the alloys now available commercially are shown in the tables. Titanium is characterized by a close-packed hexagonal crystal structure (like magnesium), but titanium alloys are unusual in possessing more than one crystal structure and it is important to learn to distinguish the types:

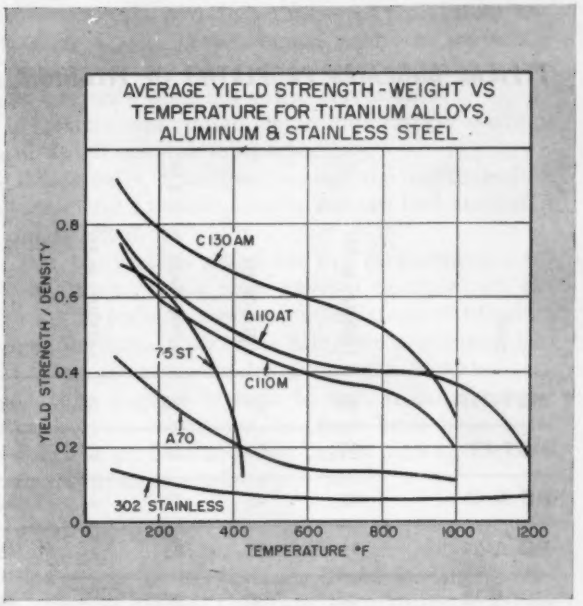
Alpha alloys are those that have the same hexagonal close-packed crystal structure in the room-temperature stable phase as does titanium, Above 1615 F, the crystal structure of titanium changes to body-centered cubic (called beta). The addition of aluminum or tin will stabilize the alpha phase. Oxygen and nitrogen, though not true alloying elements, also stabilize the alpha phase.

Alpha alloys can retain useful strength to about 1200 F, and resist air contamination to about 2000 F. They do not become brittle in response to heat-treatment, and are weldable.

Beta alloys are those that have a body-centered cubic crystal structure at room temperature. This beta phase may be either unstable or stable.

The unstable beta alloys can be quenched to give medium strength with high ductility. They can be heat-treated to higher strength after fabrication (with some loss in ductility). However, control of the composition is critical and exposure to temperatures above 350 F for prolonged periods may cause serious embrittlement.

Stable beta alloys have excellent ductility and high strength to about 1000 F. They do not respond to heat-treatment. However, they are very sensitive to contamination during production and to air



COMPOSITIONS OF TITANIUM ALLOYS

MST 3A1-5Cr	.1 max C, 3 A1, 5 Cr
MST 2.5Fe-2.5V	.1 max C, 2.5 Fe, 2.5 V
MST 2A1-2Fe	.1 max C, 2 A1, 2 Fe
RC C-110M	.2 max C, 8 Mn
RC C-130AM	.2 max C, 4 Mn, 4 A1
RC C-120AV	.2 max C, 6 A1, 4 V
RC A-110AT	.2 max C, 5 A1 2.5 Sn
RS-110	.2 max C, 3.5 Cr, 1.5 Fe
RS-110A	.2 max C, 7 Mn
RS-110BX	.2 max C, 3 Mn, 1.5 A1
RS-120	.2 max C, 7 Mn
RS-130	.2 max C, 4 Mn, 4 A1
RS-140X	.2 max C, 2.75 Cr, 5 A1, 1.25 Fe
Ti-100A	.07 max C, .30 max Fe, .30 max O, .02 max W, .02-.04 Si, .10 max N, .02-.05 H
Ti-140A	.07 max C, 1.5-2.5 Fe, 1.5-2.5 Cr, 1.5-2.5 Mo, .20 max O, .02 max W, .02-.04 Si, 10 max N, .02-05 H
Ti-150A	.07 max C, 1.2-1.8 Fe, 2.4-3.1 Cr, .35 max O, .02 max W, .02-.04 Si, .10 max N, .02-.05 H
Ti-155AX	.10 max C, .90-1.70 Fe, .8-2.0 Cr, 4-6 A1, .8-2.0 Mo, .20 max O, .02 max W, .02-04 Si, .10 max N, .02-.05 H

TYPICAL ANNEALED PROPERTIES OF TITANIUM AND ITS ALLOYS

TYPE	TENSILE, M PSI	YIELD, M PSI	ELONGATION, % IN 2 IN.	FATIGUE, M PSI	REDUCTION IN AREA, %	HARDNESS	AVAILABLE FORMS							
							BILLETS	FORGINGS	STRIP	SHEET	PLATE	ROD	BAR	WIRE
MST-III	90	80	20	55	50	60 R_A	X	X	X	X	X	X	X	X
MST-IV	100	90	16	65	—	62 R_A	X	X	X	X	X	X	X	
RC A-40	60	45	30	—	50	—	X	X	X	X	X	X	X	X
RC A-55	75	65	25	—	45	—	X	X	X	X	X	X	X	X
RC A-70	90	80	20	—	45	—	X	X	X	X	X	X	X	X
RS-55	73	62	27	—	—	85-90 R_B	X			X	X		X	X
RS-70, RS-70A	89	82	22	—	—	94-100 R_B	X			X	X		X	X
Ti-75A	80 min	70 min	20 min	—	—	85-95 R_B		X	X	X	X		X	X
MST 3A1-5Cr	155	145	13.5	90	40	—	X	X			X	X	X	
MST 2.5Fe-2.5V	140	130	12	70	65	65 R_A				X				
MST 2A1-2Fe	145	135	12	80	—	66 R_A				X				
RC C-110M	130	120	15	—	—	—				X	X			
RC C-130AM	150	140	18	—	40	—	X				X		X	X
RC C-120AV	140	130	18	—	40	—	X			X	X		X	
RC A-110AT	125	120	18	—	40	30-35 R_C	X		X	X	X		X	X
RS-110	125	116	18	—	—	26-32 R_C	X						X	X
RS-110A	126	118	18	—	—	28-34 R_C				X	X			
RS-110BX	123	117	18	—	—	25-30 R_C				X			X	
RS-120	145	134	20	—	—	29-35 R_C	X						X	X
RS-130	150	142	15	—	—	30-36 R_C	X						X	X
RS-140X	164	158	15	—	—	34-40 R_C							X	
Ti-100A	100 min	90 min	15 min	—	—	30 max R_C		X	X	X	X		X	X
Ti-140A	130-150	120-135	12 min	—	—	30-34 R_C		X	X	X	X		X	X
Ti-150A	140-165	120 min	12 min	—	—	311-364 Bhn		X			X		X	X
Ti-155AX	155	140	12	—	—	300-370 Bhn		X					X	

contamination above 1300 F. They have a relatively high requirement for strategic elements in alloying.

Alpha-Beta alloys contain a mixture of the two phases at room temperature. They combine about double the strength of titanium with good ductility, and can be forged, rolled, and formed more easily. They can be heat-treated with care and are easier to produce than the other types. However, they have poor weld ductility and a temperature ceiling of about 800 F.

Most of the alloys now commercially available are of the alpha-beta type, but some alpha alloys are available, and further developments of each type can be expected for specialized applications.

There is no standardization of alloy designations between producers yet. Rem-Cru has proposed a system of A (for alpha), B (for beta), and C (for combination alpha-beta), followed by the minimum room-temperature yield strength, and letters designating major alloying elements.

PROPERTIES

Titanium falls between aluminum and steel in density, strength, modulus of elasticity, and serviceability at elevated temperatures. Thermal expansion of titanium is about 40% less than austenitic stainless, but increases in the alloys.

Unnotched fatigue strength is good for both titanium and its alloys. Sharp notches result in fatigue strength much poorer than for steel, but round notches are not so serious.

HIGH-TEMPERATURE PROPERTIES

Titanium alloys have good properties, and the material is usually at its best in comparison with other metals, between 300 and 700 F. Above 800 F, the strength of the alpha-beta alloy drops off sharply. Alpha alloys can be used to higher temperatures, retaining useful strength to nearly 1200 F.

Oxygen and nitrogen are absorbed irreversibly in the alpha-beta alloys in prolonged exposures above 800 F, and in short exposures above 1300 F. Alpha alloys will resist air contamination to 2000 F.

CORROSION RESISTANCE

Resistance to natural environments and most chemicals is unusually good, though in those cases where titanium is attacked the rate is usually severe. In marine tests, titanium ranks with platinum and Hastelloy C, the best previously known materials. It is subject to fouling by marine organisms, but their presence does not cause corrosion.

In atmosphere, tough oxide and nitride coatings form at all service temperatures.

Galvanically, titanium is near the noble end of the scale and galvanic couples behave like austenitic stainless steel.

Titanium and its alloys are not recommended for use in fuming nitric acid. Several unexplained explosions have been reported when stressed titanium and a titanium-manganese alloy were immersed in red fuming nitric acid for prolonged periods.

At this stage it is best to test titanium under actual service conditions, as there have been cases in which it performed much better than anticipated from the available laboratory tests.

FIRE PRECAUTIONS

Fine turnings or particles from sawing operations can be ignited. Ordinary extinguishing agents are not suitable (including water, foam, carbon tetra-chloride, dry chemical, and carbon dioxide extinguishers). Fires can be extinguished by covering with approved dry-compound extinguishing powder or absolutely dry sand in the same manner as with magnesium fires.

Coarse chips and pieces of titanium are extremely difficult to ignite. Fires have started in sheet titanium removed from descaling baths when the bath temperature was above the prescribed maximum.

Good housekeeping is advisable. Turnings and metal particles should be removed frequently and placed in covered metal containers. When about half full, the contents should be removed to an isolated location.

Machining titanium

As with any new material, the first efforts to machine titanium were fraught with difficulties. There have been many tales of early production runs in which the pile of finished parts was equalled or overshadowed by the piles of scrap and exhausted tools. With more experience the proper methods have begun to emerge—there are examples today in which titanium is machined on a routine production basis.

Titanium chips curl away from the cutting edge of the tool at a sharp angle, producing severe stress concentrations and rapid temperature rise. Tool-chip interface temperatures up to 2000 F are produced.

This intense heat occurs in a metal that is a poor conductor of heat and shows a tendency to dissolve everything in contact with it at these temperatures.

Minute particles of titanium weld to the tool, dulling the edge and resulting in more pressure, which in turn causes more heat. Control of the heat at the cutting edge is necessary and can be accomplished by:

1. Adequate coolant
2. Slow speeds
3. Sharp tools
4. Proper angles

The hexagonal close-packed crystal structure of

SUGGESTED SPEEDS AND FEEDS FOR TURNING TITANIUM

	CARBIDE	HSS	CAST ALLOY
Commercially pure titanium			
Cutting speed, sfpm	300-320	150-170	170-200
Feed, ipr	0.008-0.015	0.004-0.007	0.005-0.010
Titanium Alloy			
Cutting speed, sfpm	120-160	30-60	50-80
Feed, ipr	0.008-0.015	0.004-0.007	0.005-0.010

SUGGESTED TOOL ANGLES FOR TITANIUM

	CARBIDE	HSS	CAST ALLOY
Back rake,°	0	+5	+5
Side rake,°	6	5-15	5-15
Side cutting edge, angle,	6	5-15	5-15
End cutting edge angle,°	6	5	5
Relief,°	6	5	5
Nose radius, in.	0.040	0.010	0.005-0.010

alpha titanium affords a limited number of slip or shear planes. When machining the OD of a bar with a normal orientation, the slip planes vary every 90° of work rotation. This results in changes in chip thickness and tends to develop pulsating pressures leading to chatter. To combat these conditions, rigid, well-supported tools and work are essential.

In all discussion of machining titanium it is essential to distinguish between commercially pure titanium and alloy titanium, and often necessary to distinguish between different grades of each. Even lot-to-lot variations of a particular grade of titanium or titanium alloy may cause substantial changes in machining action. This condition makes accurate evaluation of various proposals difficult.

Carbon content should be below 0.2% for satisfactory machinability. Even below this level, variation in carbon content will produce significant differences in machinability. Recognition of this has led to reduction of carbon in titanium.

Machining is more difficult when the hardness goes above 37 or 38 R_c. If the work is too soft, say about 30 R_c, there is excessive buildup on light finishing cuts, although roughing is not difficult.

Scale on the surface may contain titanium carbides, nitrates, and oxides and has an extremely abrasive effect on cutting tools. Before machining forgings, or other work with scale, it is advisable to blast with sand, grit, or shot, then pickle.

One suggested pickle is 20 to 30 min in a mixture of 10% hydrofluric acid, 5% nitric acid, and 85% water. Another is 10 to 15 min in sodium-hydride solution. For a more complete discussion of pickling procedures and the danger of hydrogen embrittlement, see the section on cleaning.

TOOL MATERIALS

Carbide tools have the red hardness necessary but tend to chip and spall. In operations such as milling, the chips may weld to the tool causing tip damage when the chip is knocked off as the tool next enters the cut.

Straight tungsten-carbide grades such as Carboloy 883, Firthite HA, Kennametal K6, and numerous similar types, give the best results.

Cast-alloy tools such as Stellite or Rexalloy require slower speeds and lighter feeds than carbide, but are less vulnerable to edge damage.

High-speed steel tools will prove the most economical for some operations, and may be the only satisfactory tools in some cases. Slow speeds are required, but edge damage is at a minimum.

Grades containing cobalt and high vanadium, such as SAE types T5 and T8, are usually best.

TURNING

Except for the need for relatively low cutting speeds, titanium and its alloys can be turned with little difficulty. If scale is present, roughing cuts should be made with a depth of cut about 3/16 in. to get below the scale. Under such conditions, such low speeds as 30 sfpm with feeds of 0.015 in. are advisable. Depth of cut in finishing operations should be 0.002 to 0.010 in.

Suggested tool angles, speeds, and feeds are shown in the tables for normal turning conditions. Rigidity of the setup is important and live centers are advisable to avoid seizure.

Turning can be done dry, but more satisfactory results are likely with a cutting fluid. Maximum cooling power is the most important criterion. Water-base soluble oils, CO_2, and a solution of 5% sodium nitrite in water have been used with good results. A soap-base material, such as Socony PB-940, mixed with water in a 1 to 20 ratio is used in a number of plants.

Surface finish is good. Maintaining sharp tools is particularly important in turning because a nick or flank wearland will promote galling and seizing of chips. This increases temperature and leads to rapid tool failure.

MILLING

Milling titanium is more difficult than turning, because the cutter mills only part of each revolution. When the cutting edge is not in contact with the work, the chip remains tightly welded to the edge and is knocked off at the start of the next cut. The edge of the tool chips away and fails rapidly.

Climb milling will minimize this difficulty. In slab or peripheral milling, the feed should be in the same direction as the cutter teeth. In face milling, the teeth should emerge from the cut on a line parallel with the direction of feed.

Caution is required in climb milling. If there is any lost motion in the feed mechanism of the table, the work will be pulled into the cutter, damaging the cutter or work.

Recent experience indicates that carbide or cast-alloy cutters are preferable to HSS, unless the latter can be resharpened and repaired readily.

Suggested tool angles, speeds, and feeds are given in tables. Note the unusual size of the relief angle.

This angle is probably the most critical. Less than 10° will lead to smearing along the flank, while more than 15° will cause chipping of the cutting edge.

Rake angles do not appear to be critical. A corner angle of 30 to 60° or a large nose radius will give a thinner chip for a given feed and minimize chipping. The longer cutting edge for a given depth of cut will distribute the force and help dissipate heat.

Water-base cutting fluids are satisfactory.

ROUTING

Titanium cannot be routed by conventional methods for aluminum. A ⅜-in. dia, two-flute router will cut stacked alloy sheets up to about ¼ in. at 1500 to 2500 rpm with a 5 to 10 ipm table feed.

A rigid setup including spindle, cutter, and work is essential. Relief angles on the cutter should be generous. Mist cooling has proved helpful.

DRILLING

Ordinary high-speed drills are satisfactory if the unsupported length of drill is kept at a minimum. Chip removal is a problem, especially as the drill dulls.

With a sharp drill the chips usually curl. As the drill wears, the chips become straighter and thicker and begin to crowd the flutes.

Failures occur not only because of wear on the lip of the drill but also because of galling or smearing of titanium on the margin. In resharpening, be sure to check the condition of the margin of the drill.

For deep holes, it is advisable to remove the drill occasionally to clear the hole and flutes of chips. (Deep holes in titanium are generally considered anything over five diameters in depth.)

Surface speeds for drilling should be 50 to 60 sfpm for titanium, and 30 to 50 sfpm for titanium alloy. Feeds are 0.005 to 0.009 ipr for drills of ¼ to ½ in. dia, and 0.002 to 0.005 ipr for smaller drills.

Point angles should be 90° for drills about ¼-in. dia, and 140° for drills ⅛-in. dia or less. In a particular setup it may be advisable to try drills of 90, 118, and 140°. The optimum point angle is influenced by the helix of the drill. Helix angles generally should be 28 to 35°. Lip relief should be 10 to 12°.

A chemically active cutting fluid, such as the sulferized oils, is important, especially on small drills.

Rigid setups are essential; therefore, use a jig and use the shortest possible drill that will permit chips to clear the flutes.

DRY DRILLING

A radically different drill for titanium sheet developed by Republic Aviation has given good results in portable drills, averaging 200 good holes per drill. With this drill, dry drilling up to depths of two diameters has been found practical.

The drawing shows the drill design and setup for grinding. The drill is short, either straight- or spiral-flute, with a heavy web. Point angle is at least 150° with no body clearance. There is no chisel point. Slow drilling speed is essential.

TAPPING

Chip removal problems make tapping one of the more difficult machining operations. This can be simplified in through holes with a gun-type tap that pushes the chips ahead of the tap.

The standard 75% thread is difficult to attain. If a larger tap drill, one that will result in a 65% thread, is permissible, there is less chance of smearing on the tap and a better fit is likely to result.

This smear of titanium on the tap is likely to lead to freezing or binding. An active cutting oil, such as a sulferized and chlorinated oil, is helpful.

For minimum deflection, two-fluted taps are recommended in sizes under ¼-20, and three-fluted taps in larger sizes. Relieving the land or removing every other tooth on the tap will minimize clogging.

Cutting speed should be 40 to 50 sfpm for titanium, and 20 to 30 sfpm for the alloy grades. If a tap should break in the hole and cannot be removed mechanically, it can be dissolved in a boiling solution of ferric ammonium sulfate without damaging the titanium.

REAMING

Conventional straight- or spiral-fluted reamers with carbide tips are satisfactory. The spiral-fluted reamer will produce a better finish. Speeds of 40 to 200 sfpm and feeds of 0.005 to 0.008 in. are satisfactory. Feeds should be increased for larger holes, but too high a feed will reduce the concentricity obtained.

TREPANNING

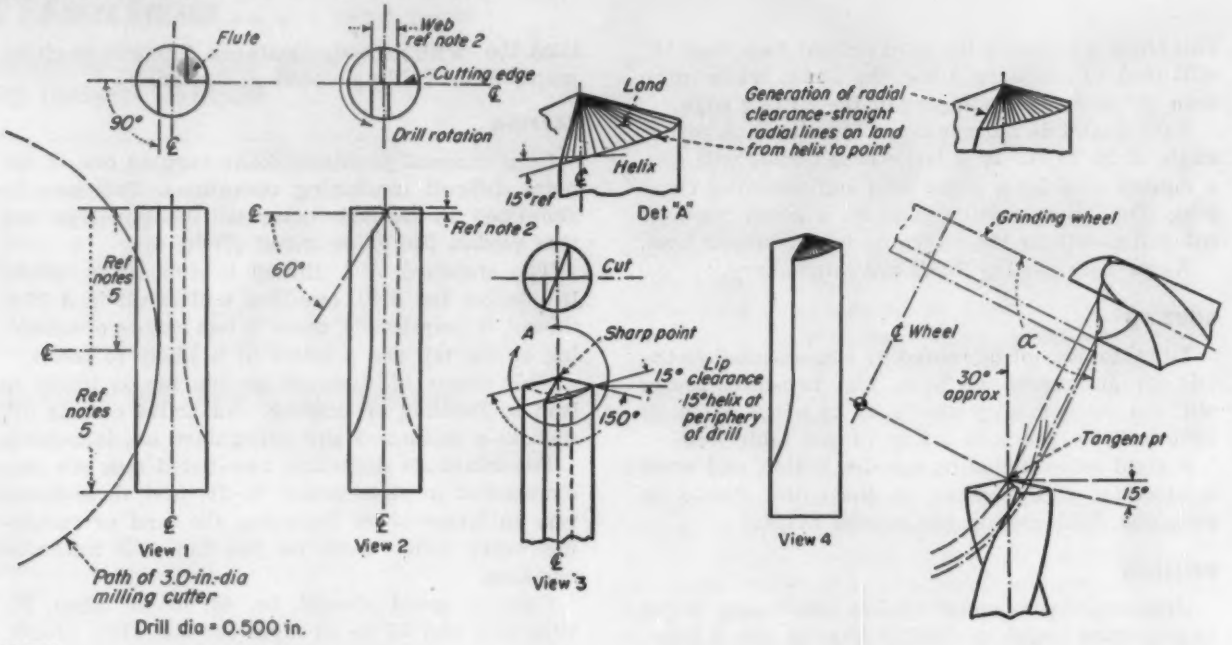
Because of the cost of titanium and the generally slow cutting rates required, trepanning can be of

SUGGESTED SPEEDS AND FEEDS FOR MILLING TITANIUM

	CARBIDE	CAST ALLOY
Commercially pure titanium		
Milling speed, sfpm	160-180	120-140
Feed, ipt	0.004-0.008	0.004-0.008
Titanium Alloy		
Milling speed, sfpm	80-120	80-100
Feed, ipt	0.004-0.008	0.004-0.008

SUGGESTED TOOL ANGLES FOR FACE MILLING TITANIUM

	CARBIDE	CAST ALLOY
Axial rake,°	0	0
Radial rake,°	−10	0
Corner angle,°	60	30
End cutting-edge angle,°	6	6
Relief,°	12	12



NOTES

1. *To determine web thickness, multiply drill diameter by 0.364 (straight-flute drill only.)*
2. *Sufficient stock to be left for cutting-edge grind.*
3. *All surfaces in contact with work to be black-oxide finished.*
4. *Drills to have no body clearance.*
5. *Drill over-all length & flute length to conform to standards for screw-machine short-length drills.*
6. *Rake angle to be 0° on both straight & spiral-flute drills.*

real saving in large, deep holes. A satisfactory method has been developed at Watertown Arsenal

The trepanning cutter is a HSS planer tool ground to the three-point design (*AM*—Jan 4, '54, p99) that produces small, broken-up chips, easy to flush out. The trepanning head must be fitted with rollers instead of the conventional wear plates. Cutting oil is supplied (through a high-pressure tube) to a groove cut in the face of the cutter that directs the oil along the cutting edges of the tool. Clearance is provided on the outside of the head for return of oil and chips and the need for an oil seal is eliminated.

Oil must also be supplied to the rollers and to a jet at the opposite side of the clearance space directed against the bottom of the hole (preventing chips from working in ahead of the trepanning head).

With a 1/16-in. ID tube, and oil supplied at 2500 psi, cuts can be made at about 60 sfpm and 0.006 ipr.

SAWING

Circular saws with inserted teeth seem to be the most satisfactory cutoff method for titanium. Rigid setup and steady, positive feed are essential. If the saw is permitted to ride on the work, the teeth dull rapidly.

A star-wheel chip remover to remove chips that adhere to the teeth is essential. With sulfurized cutting oils, a 5° positive rake and 0.017 in. between high and low teeth, cutting speeds are about 19 sfpm.

Hacksawing is successful with coarse-pitched HSS blades, 4 to 6 tpi, and high blade tension. Titanium alloy can be cut at speeds of 60 to 70 spm and feeds of 0.012 ips. Best results are obtained with a heavy flow of cutting oil with sulfur and chlorine additives. The saw must be in excellent condition and equipped with positive feed.

Wet-abrasive cutting is used increasingly. Oscillating abrasive wheels are satisfactory on bars to 3-in. dia. Larger bars are better cut by rotating the bar as it is cut.

Rem-Cru cuts large alloy sections with an Allison C60-N-RW3 wheel, 5/32x26 in., at a spindle speed of 1000 rpm and a generous supply of water and Campbelline soluble oil mixed 50:1. Cutting rate is 5 to 6 sq in. of cross-section per min with 1.2 sq in. of titanium cut per sq in. of wheel wear.

Another wheel developed for alloy titanium that works well is the Norton 37C60-POR-30. Titanium Metals Corp reports successful use of this wheel with Socony PB-940 coolant.

If there is any danger of localized overheating that might lead to thermal-stress cracking, the work should be stress relieved immediately after abrasive cutting.

GRINDING

Early experience in grinding titanium was unsatisfactory. Wheels wore extremely fast; changing to a harder wheel was no help—it caused burning of the work and did not reduce wheel wear. Wheel loading and poor finish were common.

Several developments in the last few years have completely changed this picture, and today the grinding of titanium and its alloys is not difficult provided the proper wheels, coolants, and cutting conditions are employed.

The two most critical factors appear to be grinding fluid and speed. Different tests have come up with somewhat different results as to what is the best fluid. Thus it may be best to try more than one for a particular alloy and operation.

Recent tests indicate a preference for nitrite-amine rust inhibitors. Suggested brands that are among the best are International Chemical's compound No. 47LS, Socony's rust inhibitor A, Production Specialties', Rustlick GT, and White & Bagley's Economy Liquid No. 1500. Concentrations are ½ to 1%. Excellent results are reported for a fluid developed for titanium grinding by Cincinnati Milling—Cimcool Titan.

Straight grinding oils have shown up best in some tests but present a serious fire hazard when the wheel is running at conventional speeds. With wheel speeds below 2500 sfpm, the hazard should be no greater than with steels ground at conventional speeds. Among the oils found most suitable are Houghton's Cutmax 206, Stuart's Excelene S-320, Van Straaten's Vantrol No. 5363-A, and White & Bagley's Economy Cutting Oil No. 2148.

Water-base grinding fluids seem generally a little less effective than the other types, though there is some contradictory evidence. Best results are obtained at 10% concentration, much higher than normally recommended. Those suggested as the result of tests include Houghton's Hocut, International Chemical's Compounds No. 152R with No. 52, Production Specialties', Rust-Lick L-B-25, Socony's PD 940B, Sunoco Emulsifying Grinding Oil B, and Van Straaten's Vantrol No. 630.

Grinding speed is extremely critical. For a given cutting oil in grinding a given alloy there will be a speed at which the best grinding ratio (least wheel wear) will be obtained. This efficiency will drop off rapidly in either direction from the critical speed.

For surface grinding, the best speed is likely to be as low as 1500 sfpm with table feeds of 400 to 500 ipm, downfeed of 0.001 in. per pass and 0.05 in. crossfeed.

Alumina vitrified wheels of types similar to Carborundum's C3A203-N-B5, A303-0-B5, or DA46-K9-V20, or Norton's 32A60-M8VBE or 32A80-K8VBE are satisfactory.

For internal grinding, recommendations are similar, with wheel speeds below 1800 sfpm, work speeds of 40 sfpm, and feeds of 0.002 in. Wheels should be of types such as 32A46-J8VBE or 32A60-M8VBE.

Much higher speeds in both external and internal grinding have been reported in some instances with Cimcool Titan. These tests showed a remarkably high grinding ratio with speeds of 3850 sfpm for external grinding and 4000 sfpm for internal grinding (*AM*—Jun 21, '54, p124).

BELT GRINDING

Belt grinding, if done wet, is satisfactory on the alloys and may become the favored way of finishing complex aircraft parts. Silicon-carbide belts with an intermediate (80) grit have given the best results.

A belt speed of 1500 fpm and a pressure of 100 psi are suggested. Choice of coolant is most important, as with all grinding operations. In one test of five coolants, Houghton's Cut-Max 206 gave the best results.

Heat treatment

Titanium does not respond to heat treatment, but a stress relief or annealing operation is often desirable. The alloys do respond to heat treatment but the procedures are not yet firmly established and are not generally attempted in commercial operations.

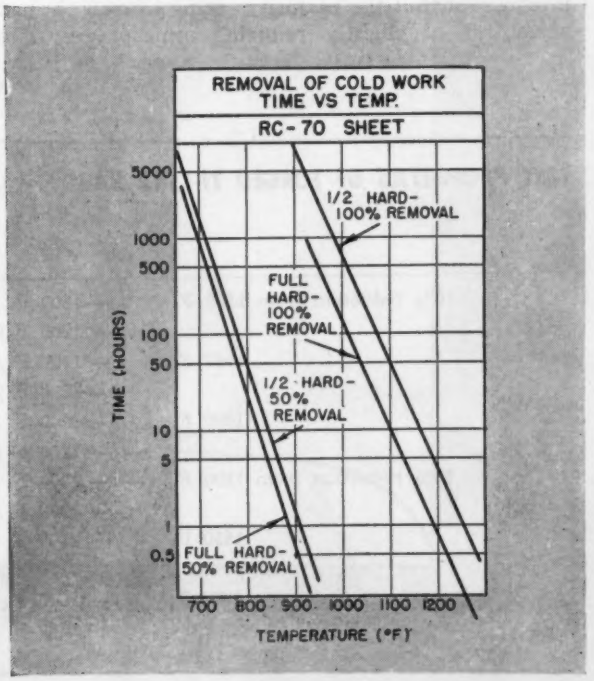
Both titanium and its alloys respond readily to cold work and reach appreciably higher strength levels. These effects can be removed by a stress relieving or annealing, if desired, with stress relieving usually preferred.

Stress-relief operations are usually performed at 700 to 1050 F. A full anneal requires a temperature of about 1200 F. Time at temperature for titanium is about 30 min per inch of thickness. Times are likely to be longer for the alloys, and vary with the composition and the structure at the start of the anneal.

Alloys are supplied stabilized annealed. If annealing is required during or after fabrication, be sure to cool slowly, otherwise subsequent applications of temperatures around 700 F may cause brittleness.

Annealing in air will produce a tight scale that is extremely difficult to remove. Annealing in argon will produce a lighter scale that can be removed by pickling.

Until the phenomena associated with quenching and aging have been more fully explored, it is unwise to attempt heat treatment without consultation with the producer of the material about the specific compositions and conditions involved.



Titanium... A SPECIAL REPORT

Forging titanium

A major part of the titanium production has been in the form of forgings and there has been more experience with forging than with many other operations.

About 30% more power is required to produce a given amount of metal flow in titanium than in steel. Small, thin forgings may require as much as 60% more power than for equivalent steel forgings.

In general, forging can follow conventional practice. Die cavities will not fill as readily as with aluminum or steel, thus more generous radii and fillets are required. Intricate closed-die forgings will probably require more die stages than they would in steel.

Interior cavities in the metal appear to forge-weld, rather than merely flatten, and leave no trace. Minor surface cracks show no tendency to propagate in forging. However, the oxide film that forms in heating causes an increased tendency to form laps.

Shrinkage allowance should be 0.100 in. per foot, compared with the 0.187 required in dies for forging steel. Die surfaces must be highly polished to facilitate metal flow.

HEATING PRACTICE

Gas-fired muffle or electric furnaces seem to have been most satisfactory. Flame must not impinge directly on the titanium. The furnace hearth should be kept free of loose scale and a sheet of stainless steel or nickel on the hearth may be necessary to prevent a reaction between the titanium and the ceramic hearth.

Scaling is a serious problem in heating titanium and there is as yet no general agreement on how to minimize it, but the majority seems to lean toward a neutral or slightly reducing atmosphere. The atmosphere must be dry—any water vapor or steam will lead to hydrogen embrittlement.

Titanium in large sections (more than 6 in. thick) should be preheated at 1400 F to minimize time in the high-temperature furnace. It should be brought into the forging range, 1600 to 1750 F, at a rate of 15 min per inch of section. The starting temperature should be so selected that forging will be finished at about 1450 F.

The alpha alloy, A-110AT, can be heated to a higher temperature than the other alloys. Rem-Cru advises starting forging between 1600 and 1900 F, though some authorities suggest going as high as 2000 or 2100 F. Finish forging should be between 1400 and 1600 F.

Alpha-beta alloys develop a coarse-grained structure when heated above 1650 F and are subject to sharp drops in ductility and impact strength unless this structure is broken up by working. Avoid holding at temperature longer than necessary. Best practice is to soak at 1200 F, then heat into the forging range of 1600 to 1850 F.

For the alloy with 5% aluminum, it is best to heat to 1850 F, and finish forging between 1600 and 1500 F. The other alloys should generally be heated to 1750 F for sections over 8 in, and to 1650 F for smaller sections, finishing between 1500 and 1400 F in either case. Give the titanium as much work as possible in the lower part of the forging range. Finishing at too high a temperature will seriously impair the properties of the forging.

As the same time, reheating should be avoided whenever possible, and it is usually better to increase the initial temperature—perhaps as much as 100 F, than it is to reheat. When reheating must be resorted to, and little reduction will be possible to

TEST PROPERTIES OF FORGED TI-150A BAR

		TENSILE M psi	Elongation in 2 in. %	Reduction in area %
10% reduction from 1500 F,	— 1200 F 1 hr AC	157.0	22	38
	— 1200 F 24 hr AC	151.8	15	17
1650 F,	— 1200 F 1 hr AC	159.0	11	15
	— 1200 F 24 hr AC	159.2	9	9
1800 F,	— 1200 F 1 hr AC	166.2	5	5
	— 1200 F 24 hr AC	158.5	2	2
50% reduction from 1500 F,	— 1200 F 1 hr AC	163.0	22	56
	— 1200 F 24 hr AC	151.7	22	23
1650 F,	— 1200 F 1 hr AC	166.0	15	23
	— 1200 F 24 hr AC	155.5	13	12
1800 F,	— 1200 F 1 hr AC	168.0	3	3
	— 1200 F 24 hr AC	165.5	2	3

refine the grain, the reheat temperature should be held below 1650 F.

An indication of the effects of forging and subsequent heating on Ti-150A bar is shown in the table. Air cooling followed all heating.

Forging should be followed by annealing at a temperature of 1200 to 1300 F and air cooling. When intermediate grinding is necessary to remove cracks, seams, laps, or other surface defects, it is best to grind with the metal at about 900 F. If grinding must be done when the work is cold, follow immediately with a stress-relief treatment, to avoid later development of cracks.

SWAGING

Titanium bars have been swaged successfully when heated to 400 to 500 F. Cold swaging has caused cracking.

Bending and forming titanium

Titanium reacts like magnesium in bending and forming operations. Best results are obtained by slow working and nearly all titanium forming must be done at elevated temperatures. Like magnesium, titanium has better formability at elevated temperatures than most other metals do at room temperature. Titanium is formed at 400 to 700 F, while the alloys require 800 to 1000 F.

Not only is cold forming undesirable because of the close-packed hexagonal crystal structure, but aircraft companies have reported difficulty in getting consistent parts from cold forming because of variations in springback. Hot forming minimizes this difficulty.

HEATING STOCK

Stock can be heated in furnaces or by resistance heating. Furnace heating is simpler and more popular but must be set up for a rapid operational sequence from furnace to forming operation. Unless this is done, especially with sheet, the stock will cool too rapidly.

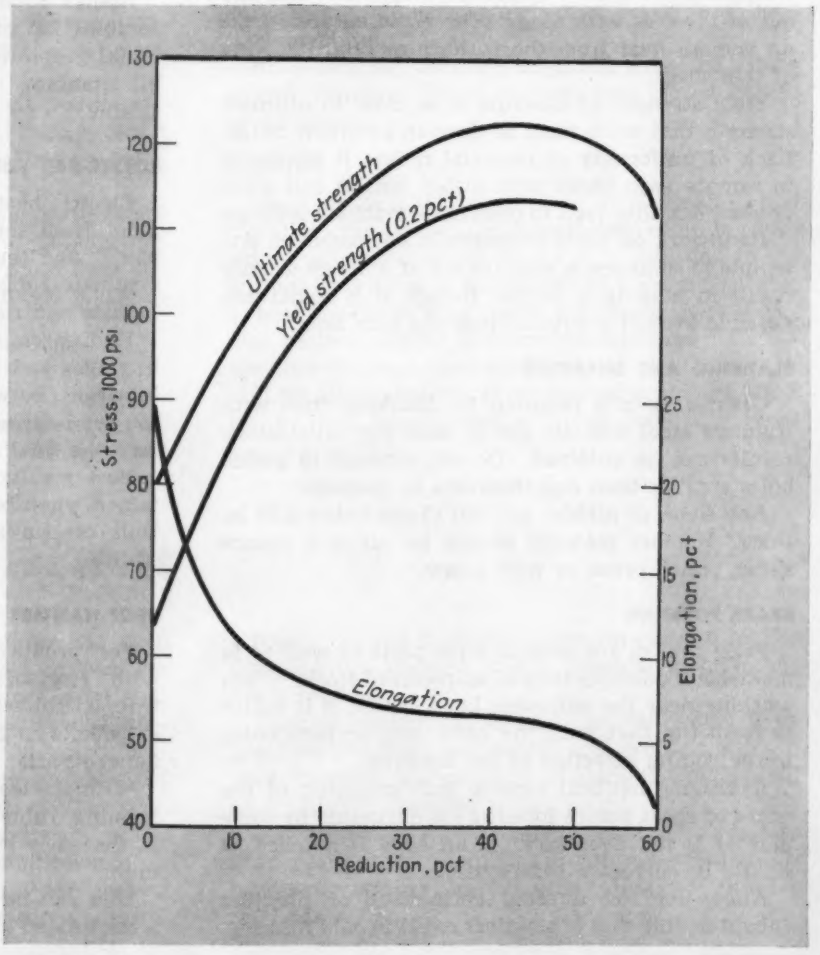
Resistance heating will eliminate this difficulty but is limited to blanks of uniform cross section and requires clamps that can be quickly attached and detached.

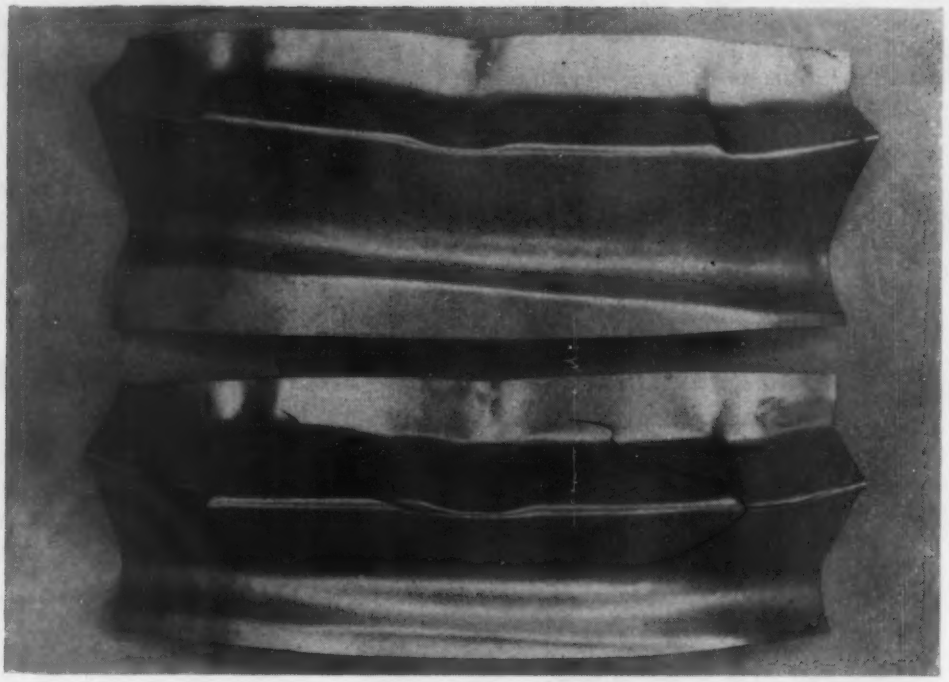
HEATING DIES

Problems caused by rapid stock cooling can be largely eliminated by also heating the dies and some prefer this method. Where high rates of heat input are required in large dies, a liquid medium for heat transfer is preferred. For lower input rates or more even temperature distribution, electric-cartridge heaters are chosen. In stretch forming, where there is limited contact between work and die at the start of the operation, it is necessary to pull very slowly to permit the die to reheat the work just ahead of the contact point. Resistance heating is likely to be best in such cases.

Rohr Aircraft has enclosed the working area of a press at the exit end of a conveyor furnace in which sheet is heated. Shielded arm

COLD-WORKING CHARACTERISTICS OF COMMERCIALLY-PURE TITANIUM. TYPE Ti-75A





EFFECT OF HEAT in forming titanium. Upper part was formed in a drop hammer with work and die both heated. Cracked part below was formed cold in the same die

openings permit the operator to reach through the transparent enclosure and manipulate work into and out of the dies with tongs. The enclosed area picks up enough heat from the furnace to retard cooling of thin sheet.

Yield strength of titanium is so close to ultimate strength that work must be done in a narrow range. Lack of uniformity of material makes it advisable to sample each sheet with either tensile and yield or bend ductility tests to determine machine settings.

Handwork on parts is generally not possible. Attempts to compress a wrinkle out of a flange usually result in making it larger, though it is sometimes possible to shift a wrinkle past the trim line.

BLANKING AND SHEARING

Greater force is required for blanking than with stainless steel and die life is less, but satisfactory results can be obtained. Do not attempt to punch holes smaller than one thickness in diameter.

Any shear or nibbler will cut sheets below 0.08 in. thick. Heavier material should be cut in a square shear, punch press, or with a saw.

BRAKE FORMING

Press brakes are used to form parts as well as to make bend ductility tests of as-received stock. When working near the minimum bend radius, it is better to form the part with the bend axis perpendicular to the rolling direction of the material.

Ryan Aeronautical reports that polishing of the edges of sheet before forming (as suggested by some plants) is not necessary. If an edge is notched, it should be corrected before use.

Allow for the unusual springback of titanium (about double that of stainless steel) in cold forming.

PUNCH-PRESS FORMING

Blanks should be profiled before forming. The combination of profiling and lubricating with colloidal graphite may permit cold forming. As with all titanium, relatively slow press speeds are desirable.

RUBBER-PAD FORMING

Electric heaters in the form blocks may be desirable. If so, temperature should be limited to about 650 F, and the large rubber pads protected with a synthetic-rubber shim pad. Glass cloth between titanium and rubber will prolong life.

Hydropress forming can be done cold by working in stages and lubricating the part with a talc-base lubricant between operations. In severe forming, the semi-formed part will have to be annealed before the final operation.

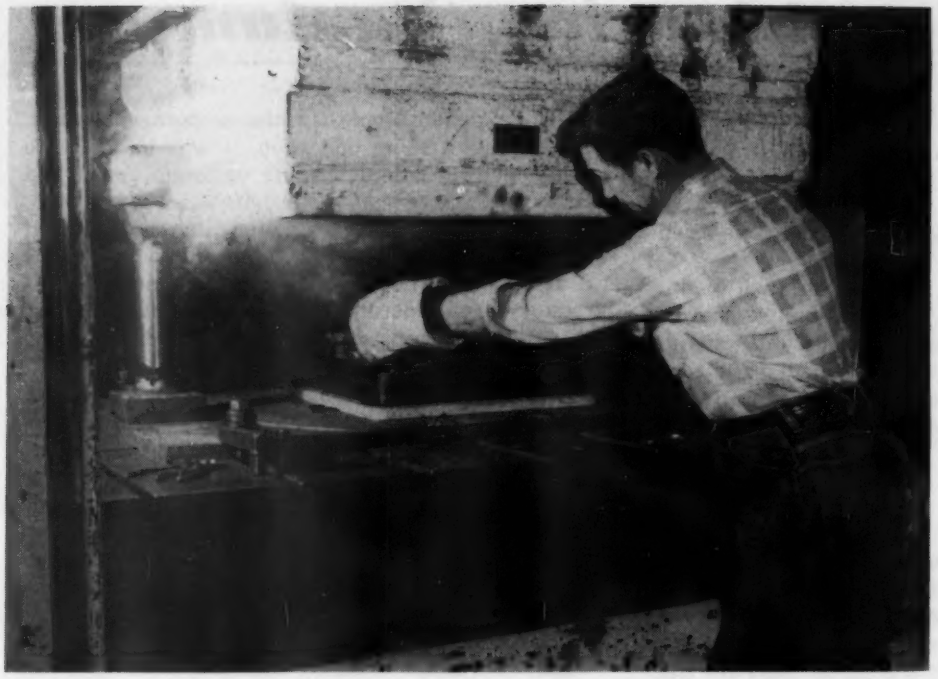
Best results in the Hydropress are usually obtained when both form blocks and parts are heated. Unit pressures to 8700 psi or higher may be desirable.

DROP-HAMMER FORMING

For production runs, best results are obtained with steel dies or hard-faced Kirksite. Either trapped rubber or a lead punch jacketed in steel is satisfactory, the former usually only for small flanged parts.

With the lead punch, a sheet of high-temperature forming rubber should be placed over the blank in the early stages to prevent fracture of the titanium.

Dies can be maintained at 300 to 400 F with the work heated to 800 F.



RUBBER FORMING of titanium at Rohr Aircraft with form blocks heated electrically by cartridge heaters inserted in the form block

DIE LUBRICATION

Usually no lubrication is required in rubber forming, unless a dry talc-base lubricant is required. Seizing and galling are common in metal dies unless adequate lubrication is applied.

Most of the experience indicates that petroleum-base lubricants are not satisfactory, though Ryan uses SAE 250 oil on punch and die between each blow in drop-hammer forming.

Molybdenum disulfide and phosphate coatings are reported as giving good results, but satisfactory methods of removing the former have not been developed. Rohr reports that they have found Warren's Plastilube to be satisfactory.

STRETCH FORMING

There is a big advantage to stretch forming because it eliminates the need for matched dies and avoids compression wrinkles. It is the best method to make double-curved parts and is often applied to curved angles and channels that have first been bent on a brake.

After bending, titanium should be annealed before stretch forming. Edges must be free of notches to avoid failure.

DIMPLING

Sheet up to 0.065 in. thick of both titanium and the alloys can be dimpled in ram-coin dimpling machines with dies heated to 750 F. In addition to the normal time delay, a dwell time of 2 sec is desirable to heat the sheet. Fine cracks may form in an irregular pattern around the circumference, so close inspection of dimples is essential.

If the titanium sheet is not heated to at least 600 F by the dies, inconsistencies in the stock may cause varying results.

Casting titanium

No widespread use of titanium castings has been made, though there are several research projects working on the problem. Wisconsin Centrifugal Foundry has made small castings in a special machine.

The casting machine is enclosed in an air-tight jacket with the titanium in an upper section separated from the mold by a molybdenum plate. Titanium is melted by manual manipulation of a tungsten electrode through the top of the jacket. When the pool of molten titanium has been built up, a hole is burned in the molybdenum plate to let the titanium run through into a graphite mold in the lower section.

Carbon contamination can be excessive from graphite crucibles and molds and would result in poor ductility and welding characteristics as well as a virtually unmachinable casting.

Powder metallurgy techniques hold more promise than casting for titanium. Brush Laboratories is producing shapes in titanium alloy by powder methods.

Titanium... A SPECIAL REPORT

Welding and brazing titanium

Resistance welding and inert-gas-shielded arc welding are at present the only suitable methods of welding titanium and its alloys. Titanium and the alpha alloys can be welded with nearly the same strength and ductility in the weld zone as in the parent metal.

When alpha-beta alloys contain less than 3% of beta-stabilizing elements, they usually can be welded satisfactorily by these methods. Alloys with more than 3% beta-stabilizing elements are generally limited to flash-butt welding.

Welds of titanium to other metals are not advisable.

INERT-GAS WELDING

Air must be prevented from reaching the weld zone if contamination by oxygen, nitrogen and hydrogen is to be avoided. This can best be done with the inert-gas-shielded tungsten-arc method, with either argon or helium as the inert gas.

Protect the underside of the metal from the air. For butt welds in thin sheet, a copper backing plate will accomplish this, provided both it and the work are flat and tightly clamped together (this will often aid in proper fit-up). For heavier material, a backing of inert gas is preferable.

A follow-up stream of the inert gas is necessary to protect the hot metal from contamination by air until the weld bead has dropped below 1400 F.

Sound welds have been made with tungsten electrodes (carbon should be avoided) with or without filler rod. Power is dc straight polarity. The arc is erratic with ac, and reverse-polarity dc will melt the tungsten.

For automatic welds, shear cuts must be straight and smooth. Best results have been reported with a gap less than 0.001 in. in 0.016-in. sheet, and less than 0.003 in. in 0.040-in. material. Excessive gaps lead to burn through in light material and a concave bead in heavy material.

Typical weld data are given in the table. Speeds of 12 to 25 imp are suggested as a starting point. Too slow a speed will cause an excessively wide bead; too fast a speed, inadequate strength. At a given material thickness, welding speed has more effect on penetration than the amperage settings. Before any welding operation, it will be safest to make test runs to determine optimum speed and amperage.

Low surface tension of molten titanium makes it desirable to weld titanium in the horizontal plane if at all possible. It also means that more skill is required of the operator than with most other metals.

If filler rod is used, be sure to provide shielding gas around it.

One solution to the shielding problem developed at ITE Circuit Breaker was to construct a mild-steel chamber on the table of a welding positioner. The chamber is kept filled with inert gas and the operator manipulates work and tungsten arc from outside the chamber through shoulder-length rubber gloves sealed to the wall of the chamber. Work is viewed through windows made of ultra-violet absorbing acrylic sheet plastic. A double-seal gas lock is provided so small tools and parts can be inserted or removed without breaking the seal.

Maximum accessibility and easy viewing should be considered in planning of fixturing. If copper chill bars can be included they will restrict the heat-affected zone and decrease the time at elevated temperatures. Because the tungsten electrode does not require local shielding, long electrodes or special shapes are possible to improve accessibility.

TYPICAL DATA FOR INERT-ARC BUTT WELDS

GAGE COMBINATIONS IN.	SPEED, IPM	HEAT, AMP	GAS BACK-UP, CFH	GAS FOLLOW-UP, CFH
0.016 - 0.016	20	18	7	3
0.025 - 0.025	20	32	9	3
0.040 - 0.040	20	50	12	3
0.063 - 0.063	20	90	12	3
0.080 - 0.080	20	140	12	3
0.125 - 0.125	20	250	12	3

SPOT AND SEAM WELDING

Resistance welds, because of the short welding time and the close proximity of the faying surfaces, can be made without resorting to inert atmospheres. They should be chosen in preference to fusion welding whenever possible.

Clean, as-rolled surfaces can be welded without further cleaning. In practice it may be necessary to clean with carbon tetrachloride, fine emery cloth, or an acid etch, depending on surface condition.

A wide variety of recommended procedures have been suggested, all reported to have produced good results. This is explained partly by variation in titaniunm from lot-to-lot and manufacturer-to-manufacturer, and partly by the fact that a variety of standard equipment and procedures will produce satisfactory results.

In general, Class II and III (RWMA) electrodes seem to be preferred with a high pressure and a short weld time to produce a fine micro-structure in the weld. One set of suggested conditions is shown in the table.

Seam welds are readily formed. Both heat and pressure should be held to the minimum that will produce good results to avoid excessive indentation and expulsion. Speeds should be 15 to 20 ipm.

FLASH-BUTT WELDING

Flash welding of Ti-150A is done on a production basis. Good results have also been obtained with

PHYSICAL PROPERTIES OF BRAZED JOINTS

SPECIMEN NO.	BONDING AGENT	TIME AT TEMP, MIN	ELONGATION, IN.	FAILING LOAD, LB	ULTIMATE SHEAR, PSI
1	Silver	4	0.0084	8175	21 800
3	Silver	3	0.0084	8300	22,133
4	Silver	1.75	0.0076	8500	22,666
10	Silver	1.50	0.0064	9040	24,106
5	"BT"	1.33	0.0084	7605	20,266
6	"BT"	1	0.0052	9275	24,733
7	"BT"	1	0.0042	7050	18,800
8	"BT"	0.833	0.0040	7300	19,466
9	EF45	1	0.0034	6250	16,666
11	EF45	0.75	0.0040	7675	20,466

Note: "BT" alloy is a silver-copper eutectic, EF is Easy Flo No. 45

titanium and with other alloys. The operation must be performed quickly.

When welding 5/16-in. rounds, about 3/32 in. of titanium was pushed up and 25/64 in. burned off with an upset force of 6000 lb. Tensile strengths of the parent metal, of flash-welded samples, and flash-welded and annealed for 1 hr at 1300 F samples, all fell in the range of 147,500 to 154,800 psi. Yield strengths were in the range 132,600 to 137,700 psi. Elongation of welded samples was off about 8% to 14 to 18%. Heat treatment produced little improvement in physical properties.

BRAZING

Limited attempts at brazing have been satisfactory when the operation is handled in an inert atmosphere. Torch brazing is possible with a special flux, but ductilities are low.

Induction brazing has been employed at North American Aviation with good results. The brazing fixture is housed in a glass bell jar to contain the inert gas.

Hard, brittle joints were encountered with brazing alloys containing copper, tin, cadmium, and zinc. Pure silver gave excellent results, producing negligible alloying effect on titanium and joint strength superior to silver alloys.

As time at temperature decreases, strength increases for pure silver joints. Titanium can be brazed to most steels and non-ferrous metals by this method, though the low thermal expansion of titanium may cause problems in joint design and fixturing. The joint clearance should not grow larger than 0.0015 to 0.0005 in. with preplaced filler metal.

Joints should be designed so the clearance will increase rather than decrease during the operation, putting the braze in compression during solidification. Too large a gap will cause splitting.

For good joints between titanium and austenitic stainless, it is advisable to first plate the stainless with nickel, copper, cobalt, or iron, or to pre-tin the joint surfaces. This will help prevent formation of chromic oxides that interfere with wetting by the brazing alloy.

Cleanliness of the joint surfaces is critical. North American reports that the best method is to vapor blast or liquid hone. This avoids chemical solutions, can remove the excess parent metal or misfits, or help rework a tight-fitting joint. It also automatically deburrs the joint edges during cleaning.

SOLDERING

The only successful soldering method reported is to coat titanium surfaces with silver in a vacuum and then soft-solder the coated surfaces together.

RIVETING

Good riveting results are obtained with standard riveting guns and bucking bars with flush rivets. Cold driving results are not consistent, and rivet temperature should be about 650 F.

Button-head rivets should be annealed for 20 min at 1300 F to set properly. Hot riveting can be done in a spotwelder fitted with counterbored electrodes to fit the rivet heads.

Dimpling can follow general practice for 7075 aluminum, if the sheet is heated to 600 to 700 F by resistance elements in the squeezers.

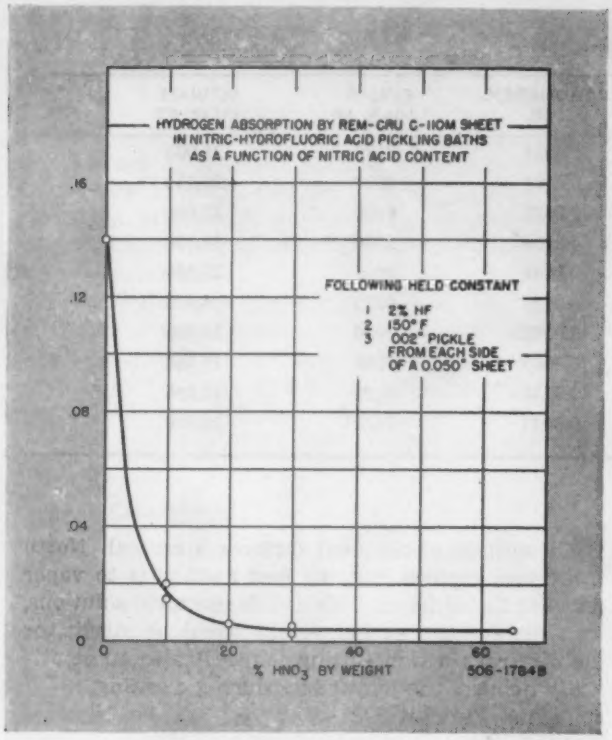
Cleaning and finishing

Cleaning and descaling operations may be by either chemical or mechanical means. Belt grinding is a good cleaning method for strip; spot grinding with wheel or belt grinders is a suitable cleaning method for sheet or bar.

Heavy pieces can sometimes be cleaned by sand or shot blasting if the matte surface produced is not objectionable.

Titanium readily acquires surface stains. These can usually be removed with alcohol or commercial detergents. No surface treatment has been reported that will modify the tendency to stain.

Chemical treatments are the most satisfactory



cleaning method but pose some special problems. Bath temperatures must be carefully controlled, for levels above 800 F have caused fires. It has also been found that a major source of hydrogen embrittlement is in the use of chemical treatments where composition is not properly controlled.

The chart shows the curve for hydrogen absorption in acid pickling baths containing nitric-hydrofluoric acid. It is evident that the nitric-acid content is the controlling factor in the amount of hydrogen absorbed by the titanium sheet. It is evident that nitric acid content should not be less than 20%.

One recommended bath is:

Hydrofluoric acid	2 ± ½%
Nitric acid	47 ± 2%
Water	Balance

The bath should be maintained at 80 ± 10 F, and the titanium immersed for 10 to 20 min. This pickle will remove less material and offer less danger of hydrogen embrittlement than any of the other baths that have been tried.

Standard 10-2 nitric-hydrofluoric acid baths for stainless steel are not advisable for titanium because of the danger of hydrogen embrittlement.

To remove heavy scale that has formed at temperatures above 1300 F, a molten sodium hydride bath at 700 F is most satisfactory. This temperature must be closely controlled and should never be permitted to go above 800 F.

One suggested cycle is 10 to 15 min in the molten salt bath, followed by a quench water rinse, then a dip in 10 to 15% sulfuric acid, followed by a dip in one of the nitric-hydrofluoric baths.

Molten sodium hydroxide (caustic soda) can be chosen instead of sodium hydride provided inhibitors are added. Without the inhibitors there is a violent reaction.

Other pickling suggestions include 5% fluoboric acid at 170 to 200 F. This will remove heavy scale but may remove too much titanium. A bath of 3% hydrochloric and 2% hydrofluoric acid at room temperature will remove scale without the caustic dip, but produces a dull etched surface.

It may be advisable to follow mechanical cleaning methods with a salt bath or acid pickle to remove imbedded particles. Caution is advised in wire brushing to avoid iron pickup.

Boeing has developed a scale-inhibiting treatment (patent applied for). A crystalline coating of carbonates and nitrates is formed on the titanium prior to heating. The scale that forms is less tenanious, and tends to crack in cooling. Much of it can be removed with light rubbing. The remainder is removed in a modified nitric-hydrofluoric acid pickle.

FINISHING

Because of the excellent corrosion resistance of titanium, no finishing treatment is required in many applications.

Anodized coatings are readily produced at about 86 F in any of several solutions. Among them are 15% sulfuric acid, 15% orthophosphoric acid, or 1% chromic anhydride.

Titanium should be degreased with carbon tetrachloride and a boiling sodium-carbonate dip, followed by a light hydrofluoric acid pickle, before anodizing. About 10 min at 10 v in the anodizing solution will produce a good film. Color depends on time in the bath and ranges from gray to brown and finally to blue.

Some electroplating of titanium has been done. Key to good results appears to be complete freedom from oxide scale on the titanium. One procedure is to use a hot-salt chrome plating solution with a hot reducing flux, in which the titanium is electrolytically cleaned and then plated on reverse current.

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SYNTHETIC-RUBBER MALE DIE is wax-brushed so molded housing can be eased out later. Female die is plaster of paris, formed by pouring it into wooden box around a precision pattern. Glass-fiber mat will be placed, then plastic resin poured onto it. Press is a drill-press fitted with a vacuum line that removes air from sealed mold to take bubbles out of plastic and insures high-grade finish

HOUSING IS REMOVED FROM PRESS after 20 min of setting, during which time vacuum pumps work. Synthetic-rubber male die is not completely rigid, and parting line of dieset is sealed during molding operation. Thus, drill-press and air pressure form housing to exact shape required. Final operations are trimming and painting with wrinkle finish

Plaster and rubber mold plastic housings

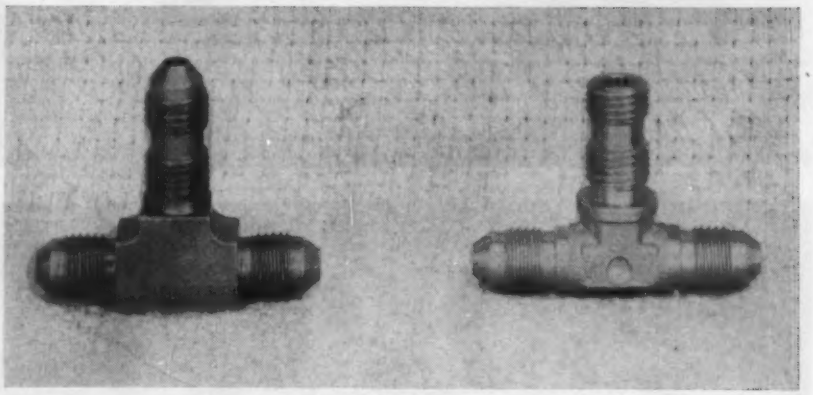
Shooting for tooling economy, the Special Parts section at Friden Calculating Machine Co, San Leandro, Calif, came up with a combination vacuum mold—and a product that will withstand a point-blank .38-caliber bullet

Friden uses these small-quantity housings for special calculating machines—called Add-Punch and Computyper. Plastic in this application replaces hand-worked aluminum that took up to 32 man hrs per piece, whereas the plastic housings are made in 4 hr. The only precision work necessary now is in making a single pattern—partly wood, partly metal—for each housing. The plastic housings can't be distinguished from metal ones except by weight and strength—proved when one of the Special Parts men shot a gun at a housing. Net result—one mushroomed bullet and one housing with a rough spot.

Is it worth the money?

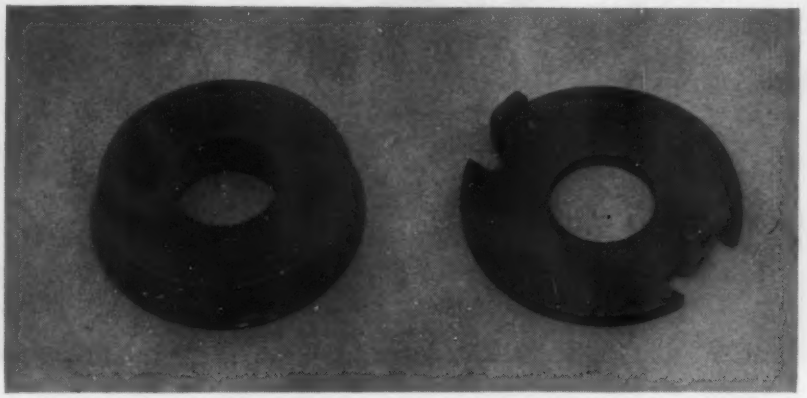
Value analysis, long-term cost-cutting program at General Electric Company (see *AM* Special Report 235, July 14 '49), continues to achieve spectacular savings. It is essentially a cooperative study of various components by Purchasing, Engineering and Manufacturing to arrive at minimum cost consistent with desired qualities. The idea has been adopted by a number of other organizations, including Stratos Div, Fairchild Engine & Mfg Co (*AM* Special Report 366, June 21 '54). Here are selected recent GE examples

LAWRENCE D MILES, Manager of Value Analysis, GENERAL ELECTRIC CO, SCHENECTADY



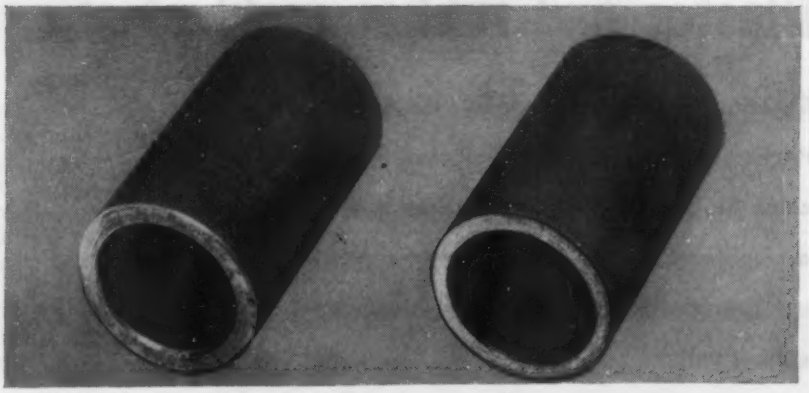
SPECIAL TO STANDARD FITTING

Cost was cut from $4.77 to $0.58 by substituting a standard AN tee with slight modifications for a special screw-machine part. Annual savings $4190, or..... **88%**



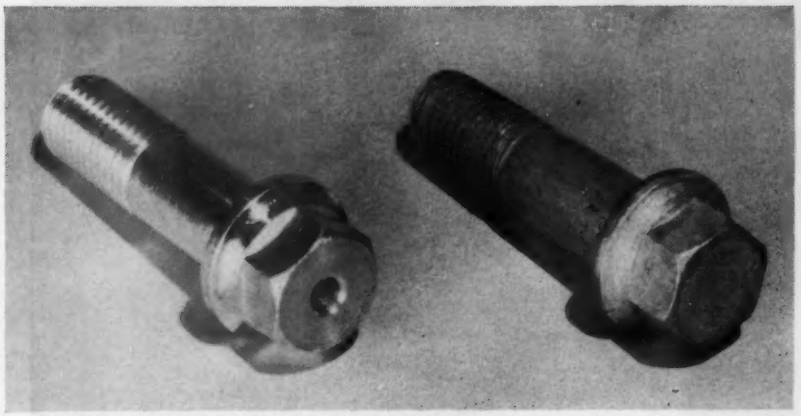
BAR STOCK TO STAMPING

Cost was cut from $1.01 to $0.11 each on this flange by redesign for stamping instead of machining from bar stock. Performance is equivalent. On 1100 pieces per year, saving was $990 or..... **89%**



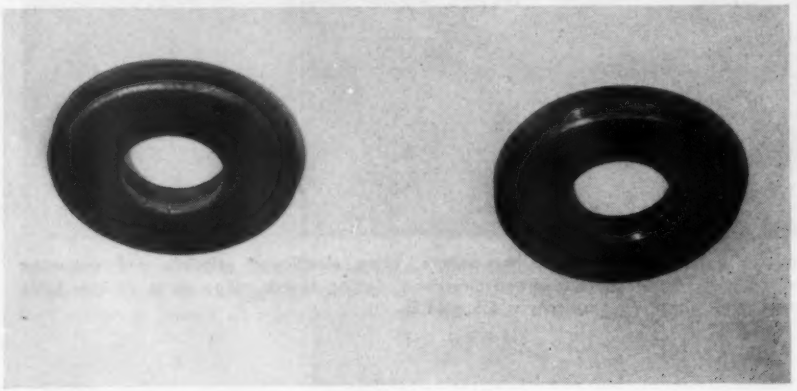
BAR STOCK TO POWDER METAL

This steel spacer, once made on a screw machine for 23 cents, is furnished in powder metal for 13 cents. Saving is $10,000 per year, or..... **44%**



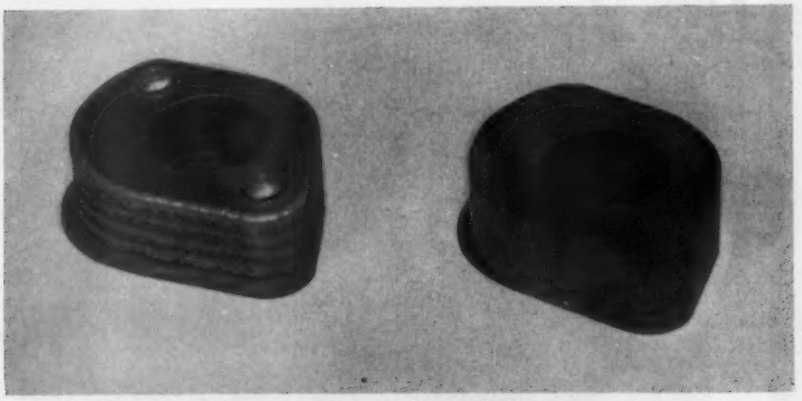
ROD TO EXTRUSION

Produced from aluminum rod on a screw machine, this screw cost 26 cents. It is now extruded, cold headed, and roll threaded from wire at 17 cents each. Annual savings $5200, or..... **35%**



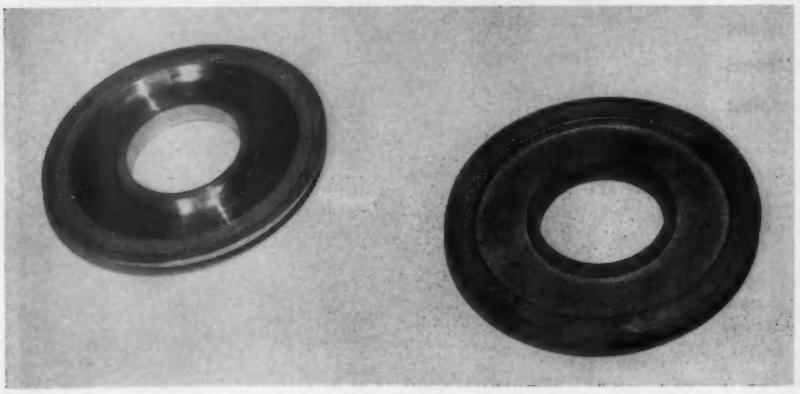
BAR TO STAMPING

Machined from bar stock, this special steel washer cost 24 cents. Punched from plate, it costs a nickel. Annual savings $2850 or **80%**



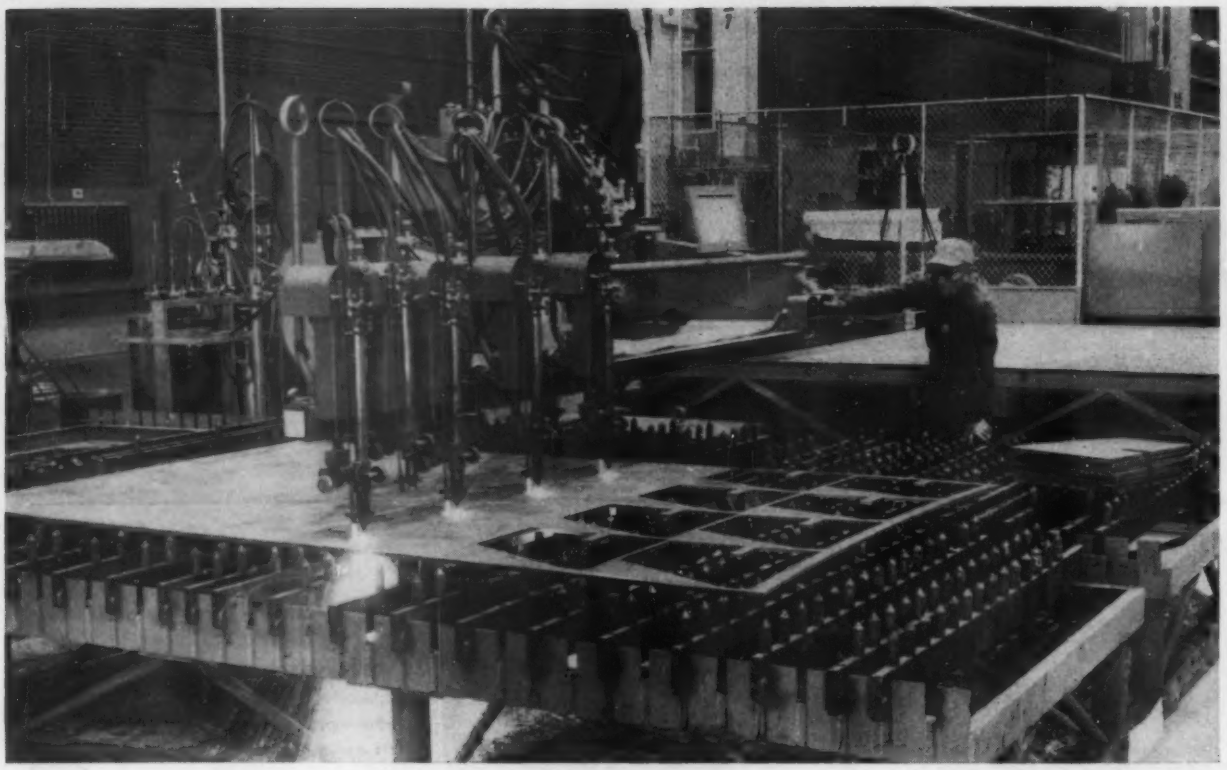
STAMPING TO SINTERING

Five stampings were riveted together to make this cam for 12 cents. It is now sintered iron and costs 3 cents. New tools cost $775. Annual savings $1600, or..... **75%**



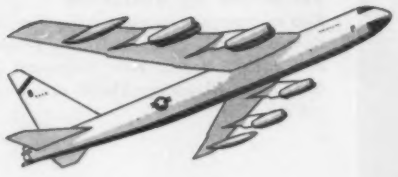
FORGING TO DIE CASTING

Forged and machined, this aluminum spring retainer cost $1.85. As a die casting requiring no machining, it costs $0.50. Tool cost was $150. Annual savings are $12,300, or..... **70%**

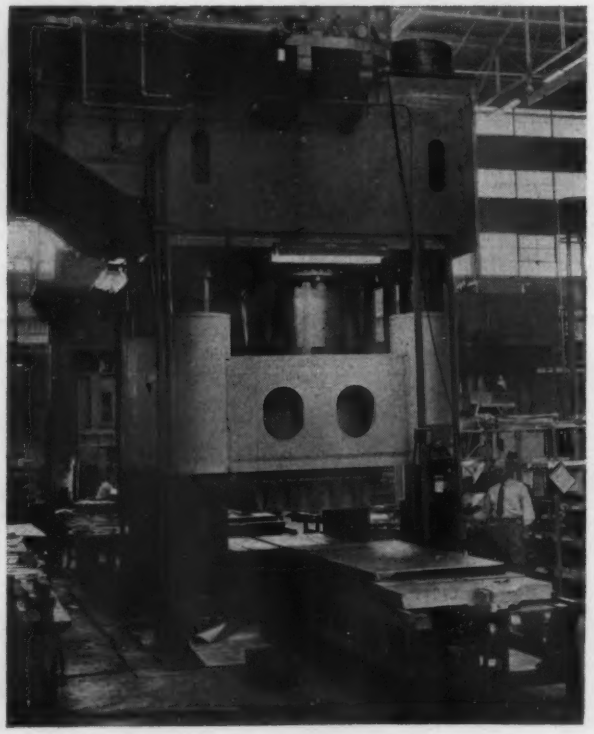


ELECTRONIC TRACER guides four flame-cutting heads on a Travograph, here cutting ½-in. steel plate. Machine is really loafing, because up to eight heads can be attached. Tracer arm works from paper pattern, using electric-eye principle and automatic feed in two directions. Cutting speeds range up to 30 ipm; table capacity is 6½ x 14 ft

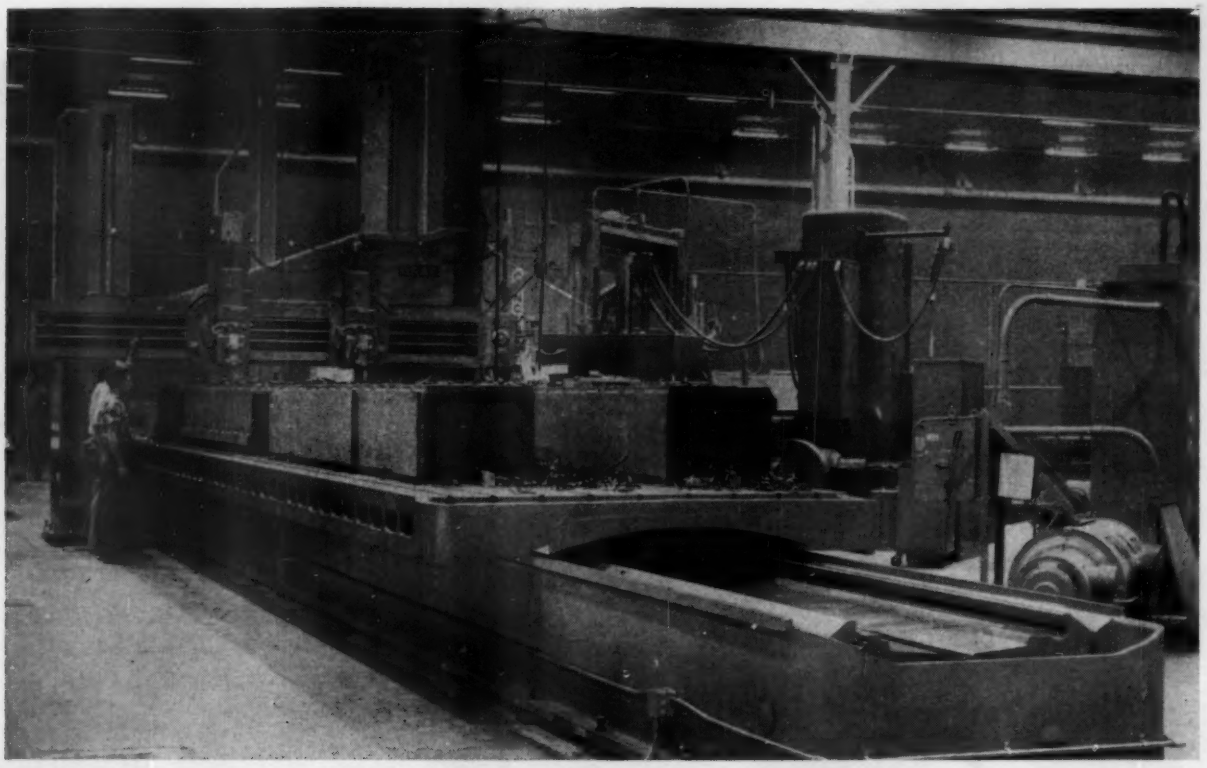
To build the B-52 . . .



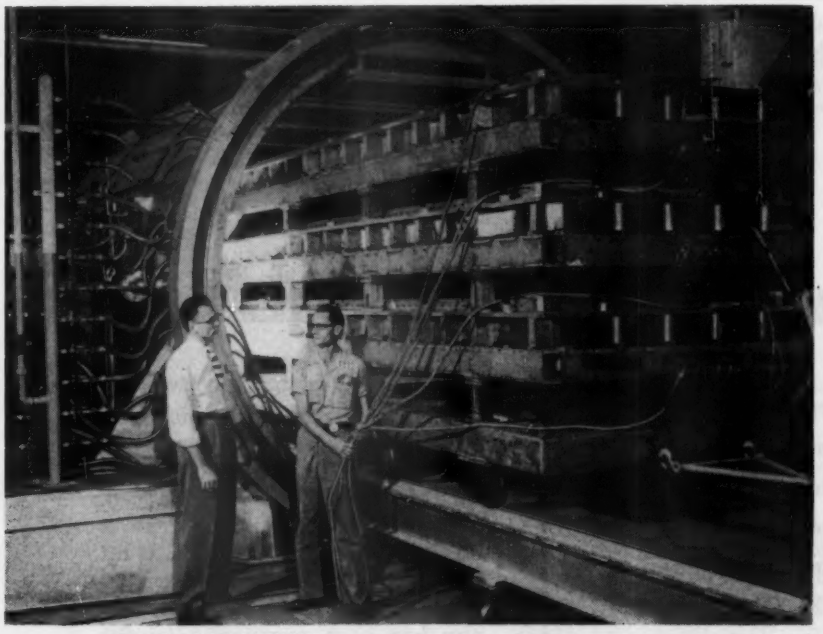
Boeing's *Stratofortress* is a big airplane, and requires big equipment while abuilding. Some of the tooling at Wichita, Kansas, is merely huge; some of it is also ingenious. Here are some examples:



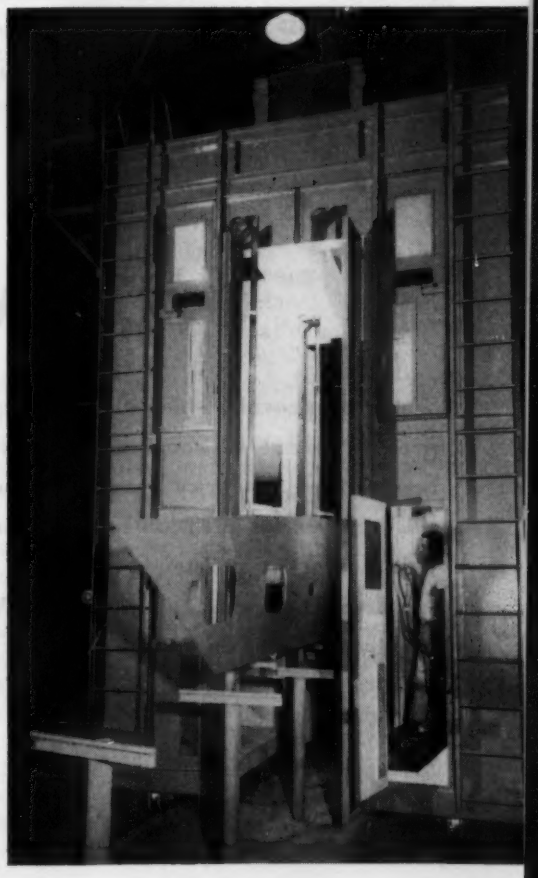
TWO DIE SLIDES keep 7000-ton hydraulic press working a larger part of the time. One slide is set up with dies and stock while other is under rubber-padded ram. Parts formed include inner skins and wing stiffeners. The Bliss Hydro-Dynamic weighs 1,000,000 lb



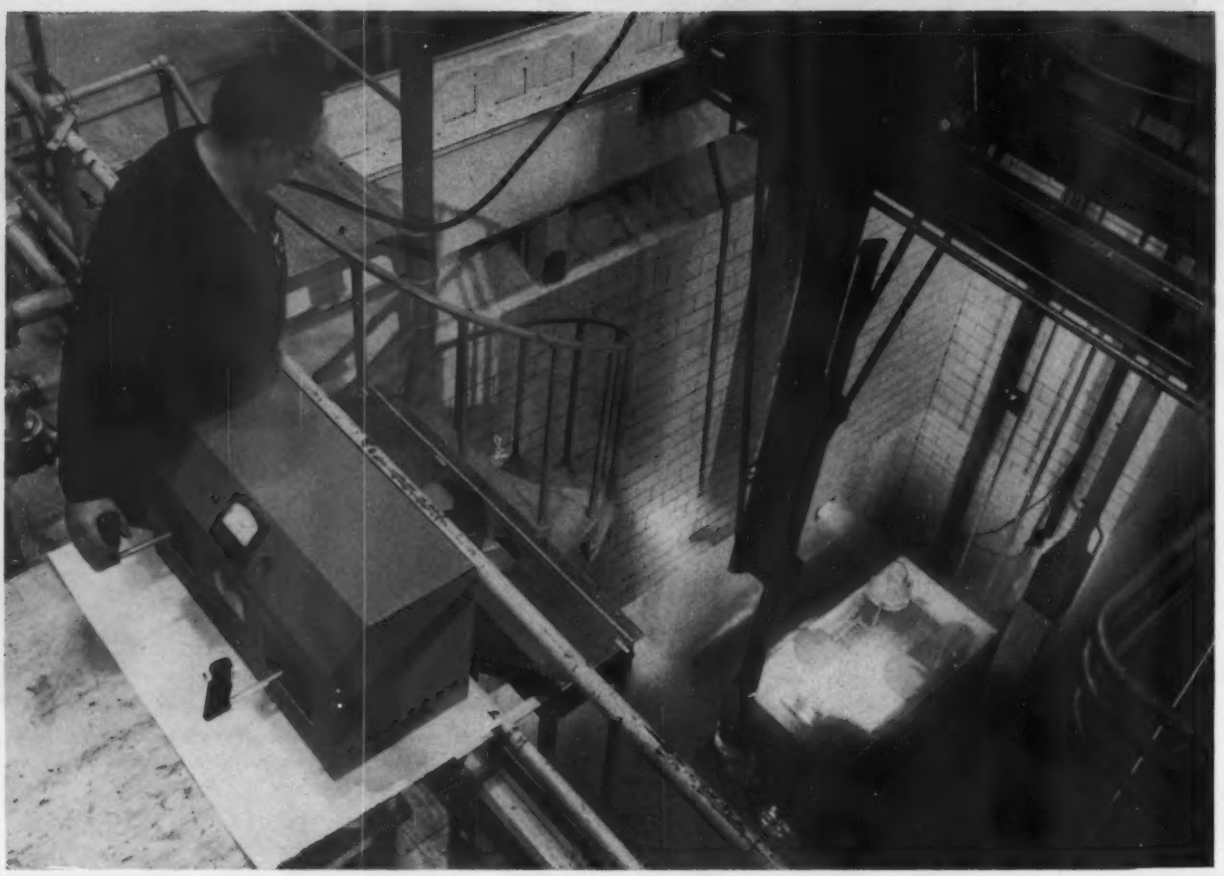
TWO JIG COLUMNS are cut simultaneously on 40-ft Gray planer tooled for one 7/16-in. roughing cut and one ⅛-in. finishing cut. Each column is welded up from three sections, then machined at one time for speed and best accuracy. Planer will handle parts up to 8 ft high, has adjustable speeds to 300 fpm, and runs on 125-hp motor



OVEN CURES ADHESIVE sprayed on aluminum and magnesium parts to be joined. Temperature is 300F; pressure inside closed oven is adjusted from 18 to 80 psi, depending on the alloys being mated. Plastic adhesive saves weight, makes smoother joints, and stands vibration. Top shear strength is 2800 psi



MOBILE PAINT BOOTH scats along rails at 25 fpm to enclose wing-skin and spar-chord sections as they are sprayed. Unit is self-contained, with water-curtain, air filters, CO_2 system, and hydraulic mechanisms. Booth has about a third of the usual accessory equipment, and uses only 12,000 cfm of air, about a tenth of normal. The DeVilbiss unit stands 17 ft high, 12½ ft wide



FUEL IS MACHINED on a special miller under water at the bottom of a pit 25 ft deep, at the reactor test site, Arco, Idaho. The electric manipulator, controlled by the handles at left, loads or unloads the machine. The vertical column with square bottom section, at right, is a periscope by which an operator on the far side of the bridge above the pit can get a closeup view

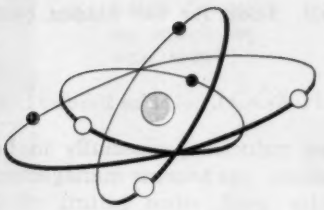
Underwater miller machines

Water pit provides shielding, removes decay heat, and suppresses spread of contamination in machining expended reactor fuel. Underwater machine tools have proved practical, with special attention to design and to materials to provide corrosion resistance. Here is more information to supplement our earlier article (*AM*, Apr 12 '54, p 166) and the cover picture on this issue

S L LINDBECK, Atomic Power Division,
WESTINGHOUSE ELECTRIC CORPORATION

Operation of nuclear power plants using solid fuel presents some very unusual machining requirements. Great quantities of intensely radioactive expended fuel are produced. This fuel material must in general be reprocessed in a chemical plant to recover unburned uranium and to obtain the yield of plutonium, if any has been produced. As the chemical-plant load will be unnecessarily increased if any excess structural material is sent with the fuel, it is desirable that such parts be machined off before the fuel is dissolved. Obviously, the fuel must be handled with precautions, which results in unusual machining.

HERE IS THE MILLER AT WORK, with manipulator at right. Control shafts at center rear rise to a a control console on the floor at the edge of the pit. They move the table vertically and horizontally. Another shaft, driven by an adjustable-speed motor in the control console, is geared to a leadscrew to feed the cutter (lower right). Revolution counters reading in thousandths of an inch indicate work-fixture and cutter motions at the console, and adjustable limit switches control length of cut



nuclear fuel

CHARACTERISTICS OF EXPENDED FUEL

Three important characteristics of used fuel dictate the precautions to be taken in handling it. First, highly penetrating gamma rays are given off by fission products. These make it necessary to use shielding material, many feet in thickness. Second, there are particles of radioactive corrosion products which adhere to the fuel surface. Precautions must be taken that these are not allowed to get into the air or to contaminate surfaces which operators may touch. This material is particularly dangerous if inhaled or ingested by men. Third, the decaying fission products in the fuel continue to give off considerable quantities of heat after the fuel is removed from the reactor. Some means must be provided to carry this heat away.

In a prototype power plant at Arco, Idaho, all three problems are solved by machining the fuel under water in a pit, as shown here. A crane-mounted electric manipulator spanning the pit, moving on rails above the surface of the water, handles fuel material in the pit and loads or unloads the milling machine. *American Machinist* for April 12, '54, showed a photograph of the milling machine with the side of the case and cover removed.

Rising alongside the control shafts in these pictures, the piping which supplies water for the hydraulic - cylinder - actuated work clamps can be seen. Two larger-diameter pipes carry 200 gpm of circulating water to collect chips produced. This water flow is taken from a shroud surrounding the milling cutter. It is passed first through a strainer basket to remove the chips, then through a microporous filter to take out the very fine particles of contamination. The chip basket is located below the water surface to obtain shielding. Water is returned to the machine housing so a minimum amount of interchange with the pit water takes place. This confines the contamination as much as possible.

The cutter is driven by a 1½-hp motor in a water-tight cast-bronze casing. The speed-reducing belt drive and spindle roller bearing are also in the housing. Whenever the machine is submerged, compressed air is admitted to the motor casing to prevent water from leaking in. Hard-tipped cutters are used to extend the operating life, as replacement must be done by remote methods.

Machine frame and housing are fabricated of stainless steel. The worktable is cast of high-nickel iron. Wearing parts such as ways and leadscrews are made of precipitation-hardened stainless steel.

Modern furnaces can pay their way

Of course, new furnaces cost more than they did a few years back. But are the price tags causing you to miss some good bets? There is a big chance for savings with the new models through elimination of operations subsequent to heat treating and by labor savings in the heat-treating setup itself. Look for the hidden costs. Maybe you can amortize new furnaces in a short period

A H KOCH, in charge Standard Industrial Equipment, SURFACE COMBUSTION CORPORATION, TOLEDO, OHIO

Cost reduction, especially in heat treating, has become management's major goal, since return of the buyer's market. Under modern conditions, fuel savings by increased operating efficiency or lower fuel costs have become secondary to the economies that lie in faster processing or the avoidance of extra cleaning or machining.

Faster heat treatment means that fewer parts are in process. In turn, the cash tied up in the business is reduced.

Further savings are realized with modern furnace equipment by avoiding: *scale formation* with its attendant loss of metal and cost of acid pickling and sand or shot blasting; and *decarburization* with its subsequent machining to remove soft areas.

PREPARED ATMOSPHERES

Production problems such as these and the potential cost savings have brought about basic changes in industrial heat-treating furnaces since WWII. For example, it has long been known that forced convection by fans will increase the rate of heating. However, in direct-fired furnaces, at temperatures where scale forms, forced circulation of the hot gases within the furnace also moves fine particles of scale around very rapidly. These scale particles rapidly wear away the refractory parts of the furnace. Extensive use of prepared-atmosphere furnaces, in which no scale forms, has eliminated this disadvantage of the circulating fan.

Application of high-capacity recirculating fans to prepared-atmosphere furnaces has increased the heating capacity from 25-30 lb to as high as 75-100 lb of steel per sq ft of hearth area per hr. This 200% increase represents a decided saving of time for many heat-treating operations.

NEW MUFFLE ALLOY

Another development has made possible large-capacity, gas-fired, atmosphere furnaces for higher-temperature operations. Maximum operating temperature has been raised from 1850 to 2050 F for furnaces with alloy muffles or radiant tubes. Gas thus can compete with electricity in furnaces processing stainless steel, or performing copper brazing, powder metallurgy and similar high-temperature treatments.

In postwar years, further research and operating experience have materially improved the manner in which gases are utilized for prepared atmospheres. Results are: (1) more accurate and constant control of the surface condition of the heat-treated parts, and (2) introduction of new processes like carbon restoration and homogeneous carburizing. Many new atmospheres have been developed.

The most extensively used prepared atmosphere is endothermic gas. Until the last year or so endothermic-gas generators were controlled manually. Now, automatic equipment is in use to keep the dewpoint of the prepared atmosphere constant at all times. This means that in gas carburizing, the carbon potential, or carbon balance of the atmosphere, can now be accurately controlled automatically to provide any desired carbon content in the carburized case. Example of use: Accurate duplication of carburized surfaces on steel transmission gears for automobiles.

No longer, as with earlier types of prepared-atmosphere furnaces, is it necessary to bring the parts being heat treated through air during transfer from the heating chamber to the quench. During such transfer, the metal is easily and instantaneously scaled by oxygen in the air. Modern prepared-atmosphere furnaces overcome this difficulty by providing a gastight inclosure between the furnace and the quench tank. This vestibule is kept purged with the same endothermic atmosphere as used in the furnace. The parts are not exposed to air until after quenching.

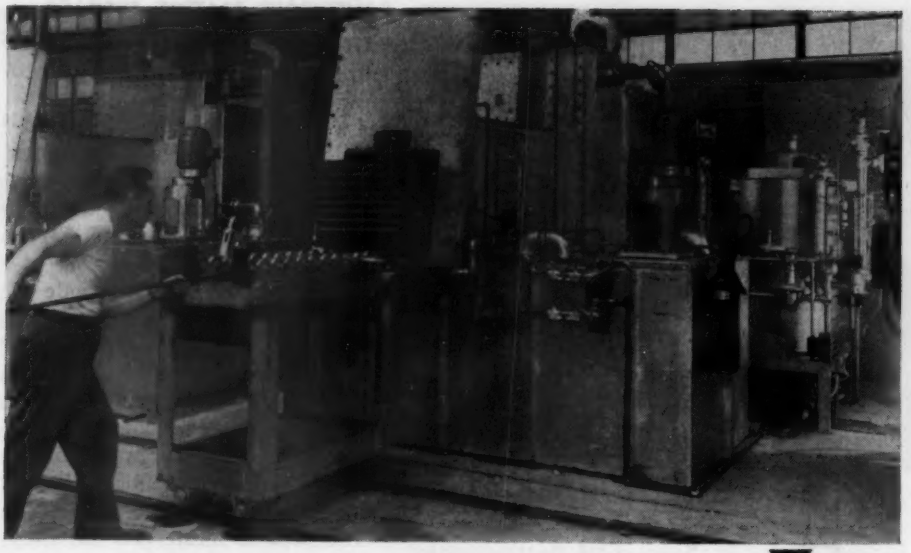
Provision of mechanical means to convey parts into, through and away from heat-treating furnaces and quench tanks has always been a major problem. The requirements vary considerably. They depend to a great extent upon the shape, form, weight and quantity of parts to be handled. If a number of different parts must be processed in the same furnace, the complexity of the conveyor mechanism is increased many-fold.

CONVEYOR PROBLEMS

The types of mechanical handling equipment used in other parts of a plant usually cannot be applied to heat-treating equipment. Furnaces operate at high temperature. Allowances must be made for expansion and contraction between the hot and cold conditions that are encountered. Also, in many heat treatments, the parts must be racked on fixtures to keep them properly separated instead of random loaded into containers.

In spite of these difficulties furnace manufacturers have made great strides in the development

Presented before the American Gas Association, April 14, 1955.



Mechanize batch furnaces as much as you want

FIG 1 . . Furnace is basically faster in operation than older types because fan circulation of prepared atmosphere raises heating rate to almost 150 lb of steel per hr per sq ft of hearth

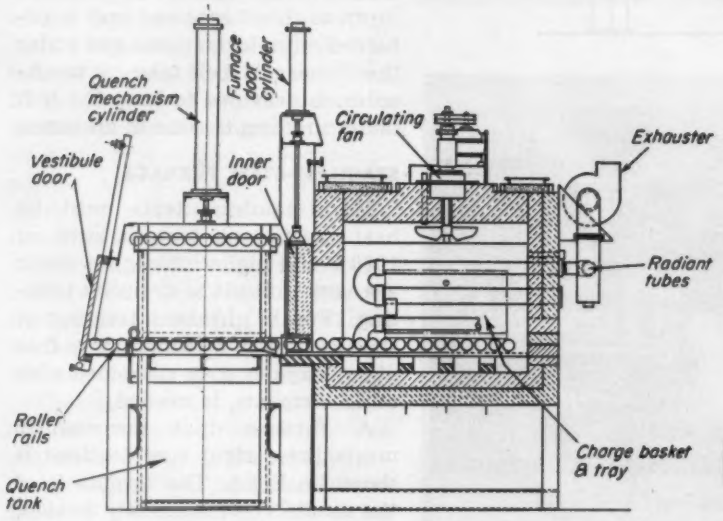


FIG 2 . . Roller rails help operator to slide basket into furnace, and mechanized quench saves labor and avoids scaling

of conveyor systems. This has brought about a material reduction in the amount of labor needed to operate heat-treating furnaces.

In addition automatic controls have been applied to conveyor systems. Without manual attention, each part is thus exposed to the various temperature cycles required for the proper period. Labor costs and the need for extensive training of furnace operators are thereby reduced.

Modern furnace designs

To illustrate how some of these features have been incorporated into modern furnace designs, consider a few typical examples:

MECHANIZED BATCH FURNACE

The Allcase furnace, Figs 1 and 2, is of the batch type and includes radiant tube firing, circulating fan in heating chamber, inclosed quench, roller rails for ease in handling charge and an elevator for mechanization of the quenching operation. The casing is of gastight construction for heat treating in a prepared atmosphere without costly leakage.

The quench tank has a capacity of 900 gal. When a full furnace load is quenched, quenching-oil temperature rise does not exceed 30 F. The quench equipment also includes a motor-driven agitator to provide uniform quenching of heavy, densely loaded charges. An elevator of double-deck construction permits a new charge to be loaded while the previous charge is being quenched, thus reducing lost time during handling.

The furnace has a hearth 24x36 in., will take a gross charge of 960 lb and has a heating rate of 880 lb of steel per hour to 1550 F.

Clean and bright hardening, gas carburizing, dry cyaniding, carbon restoration, homogeneous carburizing and similar heat treating operations can be carried out in this compact, high capacity unit.

If desired, the batch furnace can be equipped with a prepared-atmosphere cooling chamber for bright annealing and other heat treatments in which a quench can-

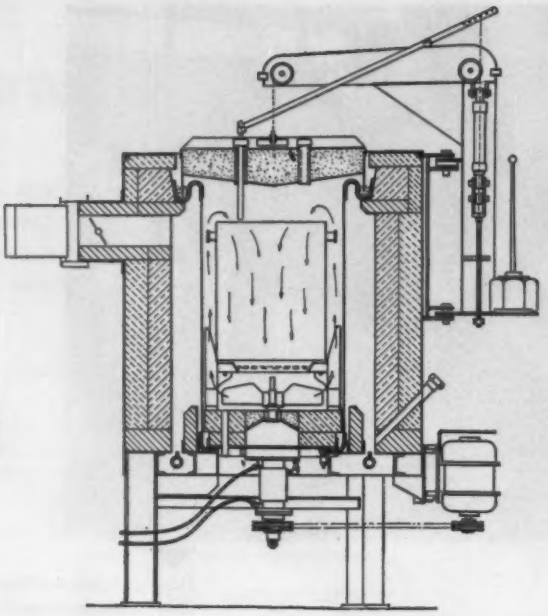
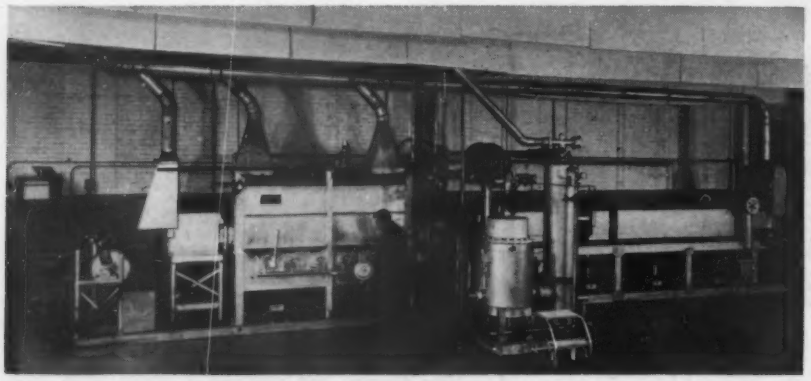


FIG 3 . . Efficiency of vertical batch-type furnaces has been raised by using a large recirculating fan for the prepared atmosphere in the muffle. About 75 lb of steel per cu ft of heating volume can be processed per hr



Modern construction avoids work discoloration

FIG 4 . . Long water-jacketed cooling chamber cools parts to temperature at which they will not discolor, avoiding cleaning operation. Muffle of special alloy steel, a recent development, allows operating temperature up to 2050 F

not be tolerated. Also, the furnace can be supplied with mechanical handling equipment to any degree desired to reduce labor. Automatic controls to interlock the handling mechanisms with furnace and quench tank operation can be provided.

VERTICAL BATCH FURNACE

Fig 3 shows the internal construction of a muffle type furnace with removable top cover. Indirect heating is employed for prepared atmosphere heat treatments. The furnace has a circulating fan in the heating chamber, and does not require compressed air for combustion of the gas fuel. The large-capacity circulating fan plus controlled flow of the atmosphere in the muffle makes it possible to heat heavy, dense charges rapidly and to a high degree of uniformity.

Efficiency of a vertical batch furnace of modern construction ranges from 360 lb of steel per hr for a heating volume of 4.8 cu ft to 575 lb for a furnace volume of 10.2 cu ft.

Clean annealing, clean hardening, dry cyaniding and all types of gas carburizing heat treatment can be done. A separate quench tank or a prepared-atmosphere cooling chamber can be used.

CONTINUOUS BRAZING FURNACE

Of fully standardized design, the continuous brazing furnace shown in Fig 4 consists of a heating chamber with subsequent cooling chamber through which a continuous mesh belt is fed to convey the work. This furnace is of the muffle type, indirectly heated, so that it can be used with a prepared atmosphere. The muffle is made of special alloy steel when maximum operating temperature is 2050 F—or of silicon carbide construction for operations requiring higher temperatures. The long water-jacketed cooling chamber drops part temperature sufficiently to avoid discoloration at discharge.

The woven mesh belt of alloy steel is driven by a rubber-covered drum at the charge end and is returned on rollers outside and under the furnace. A belt take-up mechanism is provided to keep the belt under uniform tension at all times.

STAINLESS-STEEL FURNACE

Most stainless steels must be heat treated at temperatures of 1900 F and higher. Stainless steels are very difficult to clean by pickling. For bright heat treating of stainless steels, an atmosphere free of any oxygen, even combined with other elements, is needed.

A furnace that successfully meets these rigid specifications is shown in Fig 5. The furnace is of the muffle type, indirectly heated, with direct-connected water-jacketed cooling chamber and charge and discharge vestibules.

The Inconel furnace muffle is of circular cross section to minimize internal stresses, which shorten alloy life. Gas burners fire tangentially to the inner surface of the refractory lining, over and under the muffle, and thus provide rapid and uniform heating.

Vestibules are located at both ends of the furnace, and are equipped with gastight inlet and outlet doors. This design of vestibule serves as an atmosphere lock and purge chamber to prevent air infiltration that will contaminate the prepared atmosphere in the furnace or cooling chambers. The sealed vestibule type of construction of the stainless-steel furnace materially reduces the quantity of

atmosphere required, and thus keeps furnace operating expense within reasonable limits.

MECHANIZED OVEN FURNACES

In recent years, standard large oven furnaces have been equipped with roller rails on the hearth, and combination pusher and puller mechanisms for ease in handling furnace charges placed on trays outside of the heating chamber. The trays are hooked together with inverted, U-shaped links, and the entire furnace charge is handled at one time. A typical furnace of this design is shown in Fig 6. Where the parts are sufficiently large and have proper end surfaces, the trays are not used.

"Packaged" continuous furnaces of this type save the field erection costs. Originally, the length limitation of a shop-built furnace was 24 ft. Now they are built in two sections and bolted together at destination. Pusher and puller mechanisms are shipped as separate units and attached to the furnace structure when it is installed.

Maximum width of a shop-built furnace of this design is limited by freight-car width (11 ft). Thus, the actual effective width of the furnace hearth is less than 72 in.

The pusher and puller mechanisms consist primarily of a charge table with roller rails, pusher heads, pull-out hooks and some type of power drive. The drive selected depends upon local conditions and preferences. The most common types are:

Continuous chain with reversible electric motor.

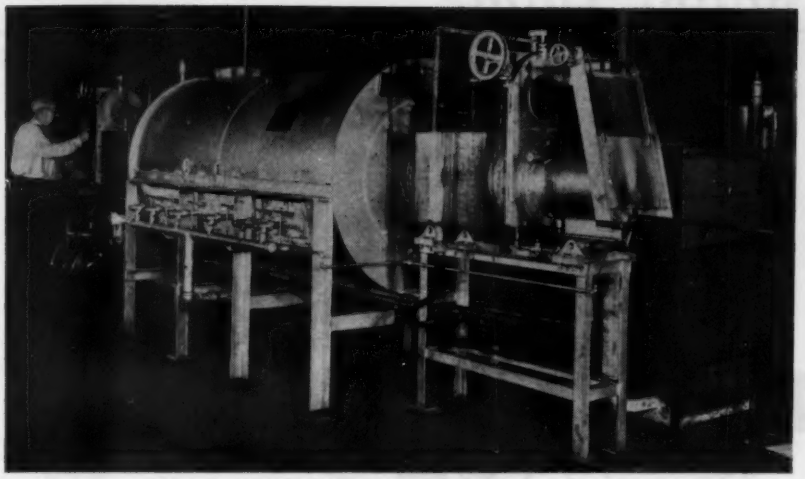
Rocker arm with electric motor.

Rocker arm with hydraulic or air cylinder.

Direct connected hydraulic or air cylinder.

Air-operated cylinders for this application have a jerky action, but an "airdraulic" system gives smooth and easily controlled operation.

Automatic control of mechanized oven furnaces is another noticeable trend in furnace design. Doors operated mechanically by air cylinders or electric motors are completely interlocked with pusher and puller mechanisms. Thus, a complete cycle of charging and discharging can be obtained without manual attention. These control systems can also be arranged to be operated by timers so that all the parts being heat treated are automatically subjected to the same established time-temperature cycle.



Sealed vestibules protect stainless steel

FIG 5 . . No oxygen, free or combined, can be permitted in a furnace used to bright heat treat the stainless steels. Sealed charge and discharge vestibules prevent air infiltration and reduce consumption of prepared atmospheres

Big furnaces built in sections

FIG 6 . . Pusher mechanism at charge end of oven furnace places heavy trays in heating zone. Automatic control of doors, and pushing and pulling of trays, will eliminate manual attention. Modern furnaces are shop built in sections to reduce costs

ECONOMIC FACTORS

The modern prepared-atmosphere furnace is costly to design and build. It must be of gastight construction. Conveyor equipment, as well as automatic controls, are expensive. These factors have raised the price of modern furnaces to a figure that is rather high as compared to what industry has been accustomed to in the past. However, this situation is common with all classes of capital goods. The big question that management should ask itself is: "Will modern furnaces justify their cost by elimination of processes subsequent to heat treatment, abolishing of costly rejects, and saving of labor?" Very often, the reduction in over-all costs is sufficient to amortize the required investment within a short period.

Round Table

Time-and-a-half vacation

"Ed, here's one that will give you a laugh. I asked Hank Boles to work some overtime Saturday, and he turned me down."

"So what, Al? He doesn't have to work if he doesn't feel like it."

"No, not overtime. But I should think he'd want to get the money."

"It depends, Al. Tell me, did he miss a day during the week?'"

"Yeah, he was out sick Monday."

"That explains it, then. He figures all he can get out of Saturday is straight time."

"Well, of course—he hasn't worked 40 hours yet. But so what? As it is, he'll only get four days' pay."

"I know, Al. Even though he'll come out loser, he probably figures that Saturday is a time-and-a-half day, no matter what, and he doesn't want to work it just for straight time."

"Now that's a foolish attitude. The only one he's hurting is himself. He'll get a paycheck a whole day's pay short, because he was ill; but he won't work Saturday on straight time."

"It sounds foolish, but I think that's what's bothering him. He'd have to work alongside of some other guys who will be getting half again as much money as him. And he won't like it. Therefore, no work."

"What do you suggest; that we pay him overtime because it's Saturday?"

"I suppose not; but maybe the company should work out some kind of deal to get him to make up the lost time."

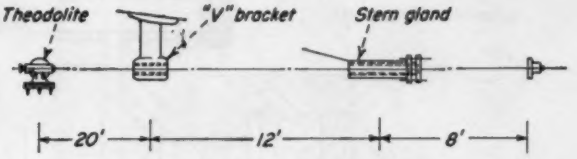
"We have a deal—he can work tomorrow. He's crazy if he expects extra pay under 40 hours. After all, the company isn't responsible for his missing a day."

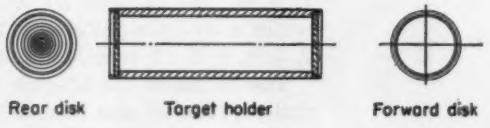
"Maybe not, Al, but I know this thing is quite a problem. If we have to get the work out, we'll have to figure out some way to get the men to come in on Saturday."

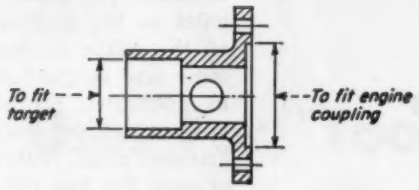
"I can fix that, Ed. I'll ask somebody else—someone who's worked the whole week so far, and can make that extra pay."

***DO COMPANIES** often lose out in getting extra work done because a man may have missed a regular working day, and won't work Saturday for straight time? Should a man who's been sick get an extra break; or is he lucky to get a chance to work the extra day on straight time? Your opinions may help guide others.*

Practical Ideas . . .







Targets Line Up Prop Shafts

We were very interested in the Practical Idea "Telescope Cuts Inspection Time" (*AM*—Feb 14, '55, p156). We have used a similar method when aligning propellor shafts of speedboats. The boats, which had seen some sea time, were out of shape and the shafts were causing us trouble. The shafts were 2½ in. OD, about 20 ft long, and operated at 2400 rpm.

Before pulling the boat out of the water, we had three brass plates with engraved lines fastened to each side of the hull and aligned with a piano wire. On the slips, the boat was jacked up until the proper alignment was again secured.

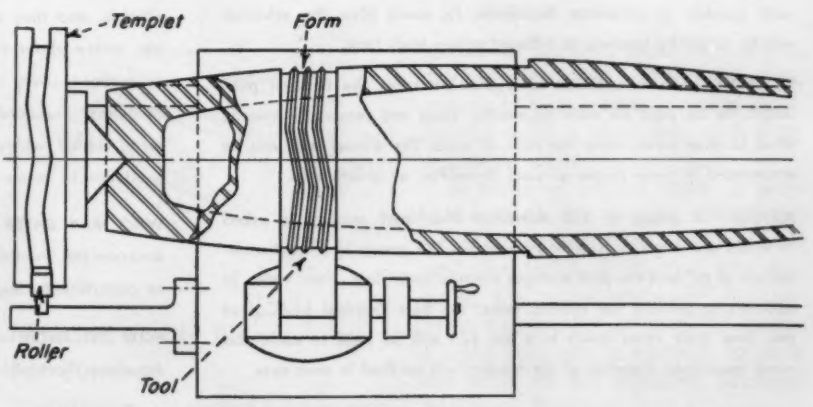
We then pushed targets into each bearing bracket and onto the engine coupling. The targets were brass tubes, of a sliding fit in the bearing housing. Both ends were closed by transparent disks, one of which was marked with a cross, while the other had concentric circles. We put a theodolite astern of the last bracket, and a lamp near the engine coupling, and adjusted the line of sight of the theodolite.

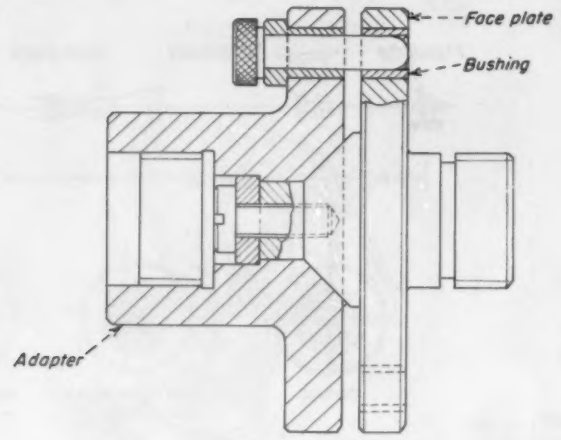
This arrangement allowed us to first determine how much the bearings were out of line, and also if the engine alignment was correct. By using the optical method, much greater accuracy was attained, and the bearing housings could be removed to be shimmed or shaped off without disturbing the line. Final alignment was made with a single target disk, to eliminate any refraction of the light beam. *Alexander Gilat, Haifa, Israel*

Faceplate Templet For Wave Form

We had to cut a precision wave form on a shell, and decided to use a lathe and faceplate templet, as shown here. The templet had the desired form with a width just equal to the diameter of a roller which was connected, by a heavy bar, to the compound of the lathe.

A form tool with the wave profile was put in the cross slide, and the compound guide bars were freed and oiled. The lathe was started, in slow speed, and the cross slide was fed in, thus accomplishing the form. *R Danbert, Base Line, Mich*





Adapter For Multi-Lead Threads Permits Up to 48 Starts

Experimental departments and prototype shops are sometimes called on to make small batches of multi-lead threads. For some years we have used a simple fixture for cutting such threads without altering gears, making calculations, or doing any other such preparation.

The adapter we use screws onto the lathe headstock, and its front end is bored out to form a bearing surface to take the tapered spindle of a faceplate which is held in position, without end play, by a screw and thrust washer.

The face plate has a series of holes drilled, reamed, and hard bushed, equally spaced to form a division plate. Any number of holes can be used, depending on the number of starts needed. (We make as many as 48-start threads.) A plate with 30 holes will start 2, 3, 4, 6, 10, 15, and 30 locations, while a 24-hole plate will handle 2, 3, 4, 6, 8, 12, and 24 starts.

The flange of the adapter is also drilled, reamed, and bushed to take an index pin which locates in the holes in the faceplate. The front of the plate is threaded to the same size as the lathe headstock. In operation, the chuck holding the work is screwed onto the false mandrel nose. With the index pin at zero, the first cut is taken. The faceplate is then indexed, the second cut is taken, and so on.

The faceplate can be provided with detachable index plates, thus giving it a wider range of starts.

A V Reed, Herefordshire, England

Winner No. 229 of $25 IN ADDITION TO REGULAR PAYMENT

for the best PRACTICAL IDEA

IN THE JUNE 6, 1955 ISSUE, A TIE. $25 EACH TO:

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An extra payment of $25 is made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

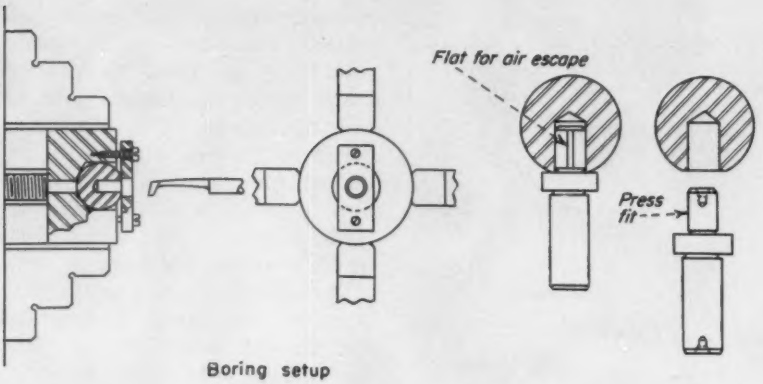
PAYMENT — $25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received — usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES — A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

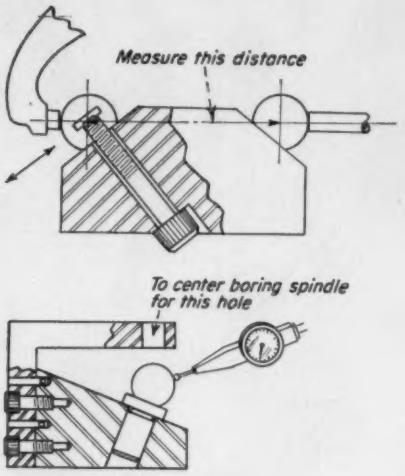
REQUIREMENTS — Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author — every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product — in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N Y



Boring setup



Examples of application

Shop Uses For "Tooling Balls"

For many years I have made use of "tooling balls" for layout and inspection of holes bored in compound angular surfaces and inaccessible setups where the common toolmakers buttons or cylindrical plugs would not do the job. These balls equipped with accurately centered shanks have not in the past been available from any source that I know of, and the machinist who wanted to make his own was often balked by the problem of producing a perfect sphere accurately centered on a shank with all wear surfaces hardened.

This is the method I have used to solve the problem:

Hardened steel balls of a high degree of perfection are easily obtainable from ball bearing makers. Annealing these balls by ordinary methods makes them useless because of scale and pitting. If you have a controlled-atmosphere furnace, this is not a problem. For the small shop, though, either of these two methods are recommended:

Pack the balls tightly in a piece of steel pipe filled with cast iron chips. Cap the pipe tightly at both ends and place in the annealing furnace.

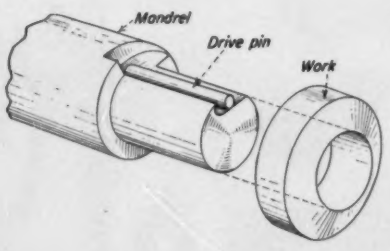
Copper plate the balls lightly. Copper will protect the polished surfaces at ordinary annealing temperature.

Machining the hole in the ball is made easy with a simple chucking block bored or precision ground to a tight fit on the ball. A strap clamp holds the ball in the hole during machining. (This hole can be ground, if desired.)

After machining, the ball can be re-hardened by soaking in a pot of hardening salts, and, if care is taken and the ball is quickly quenched, the surface will be free of scale.

A threaded ball is useful for certain jobs. The hole may be made by the same method as above, but the thread should be chased, to maintain squareness of thread and shank.

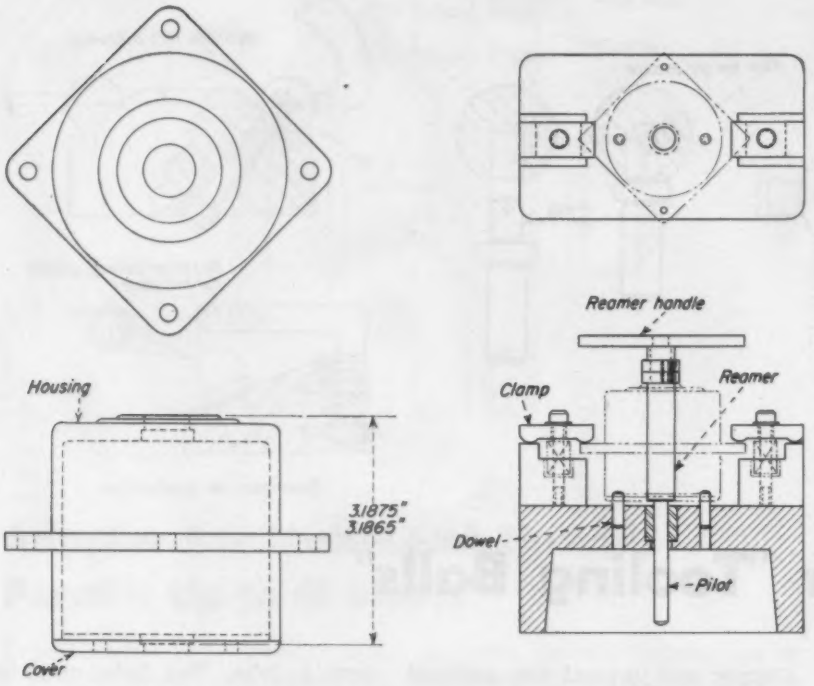
The shanks should be hardened and ground on centers. Perfect concentricity is most important. The shanks may be made in a number of sizes, for various diameters of workpiece holes. If the shanks are made to a wringing fit, the balls may be exchanged from shank to shank, rather than making a separate ball for each different shank size. *H J Gerber, Stillwater, Okla*



Mandrel Holds Rings For Turning

The attachment shown here is very useful for holding thin rings which are to be finished on their OD. The mandrel is simply a piece of steel turned with a shoulder, and with a groove milled in one side.

A piece of round steel is provided to fit the groove. When the work is slipped over the mandrel, and the lathe is started, the pin grips the work securely. To remove the work, just stop the lathe. Finger pressure is enough to pick the work off the mandrel. *Michael P Blake, Bombay, India*



Hand-Reamed Holes To Close Fit

The fixture shown here was designed to assure a correct lineup of two holes and to hold the 3.187 ± 0.0005 in. dimension. The work is in two parts which, when assembled, hold a small electric motor through bearings pressed in counterbores.

The fixture holds the housing and cover as a unit, and guides the hand reamer to line up the bores, holding tolerances to required accuracy. The work is cast aluminum, with 0.005 in. molded on the ID of the bores, and 0.002 in. on the depth of the bores.

The fixture has a base with clearance to allow the pilot of the reamer plenty of room to clear the bench. The gage-block locating surface is machined to hold the blocks which support the outboard end of clamps. The blocks are bored for springs, and drilled and tapped for clamp screws. Dowel pins pressed into the base are made a snug fit for the two holes in the cover of the housing.

The pilot, hardened and ground, is made long enough to enter the bushing before the reamer enters the bearing hole in the housing.

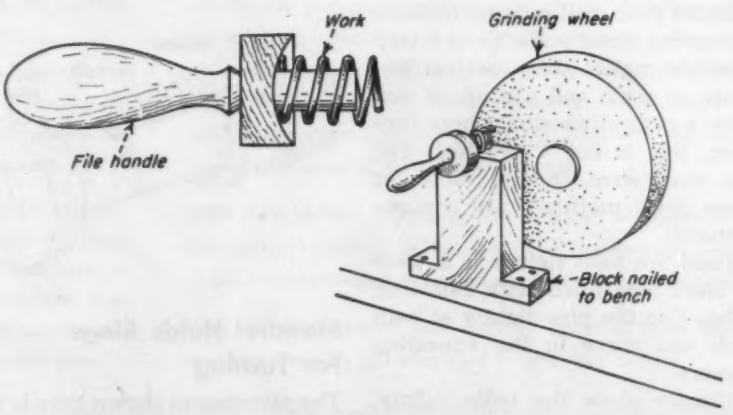
In operation, the parts are assembled and placed in the fixture, with the cover resting on the machined surface of the cast iron base. Two holes in the cover are located on the dowel pins, and the housing is located on pins, which prevent the work from turning during reaming.

Clamps are swung into position and tightened, holding the work steady. The reamer is started into the work, the pilot guiding the tool to correct location. When the correct dimension has been reached, the nut stops the reamer. This nut is adjustable for tool wear, and is set by a toolmaker using a height gage. This takes most of the responsibility for accuracy out of the hands of the operator. *Alex S Arnott, Ontario, Canada*

Squaring The Ends Of Coil Springs

We had several thousand coil springs, ¾ in. OD, 1 in. long, consisting of 4 turns of 0.085-in. wire, both ends of which had to be ground smooth.

We tried holding them against the grinding wheel by hand, but that was slow and dangerous. We then made a mandrel for them, nailed a block of wood to the workbench under the small grinder. Notice that the shoulder on the mandrel for the springs must be concave, to prevent chatter. *J H Sperman, Brooklyn, NY*

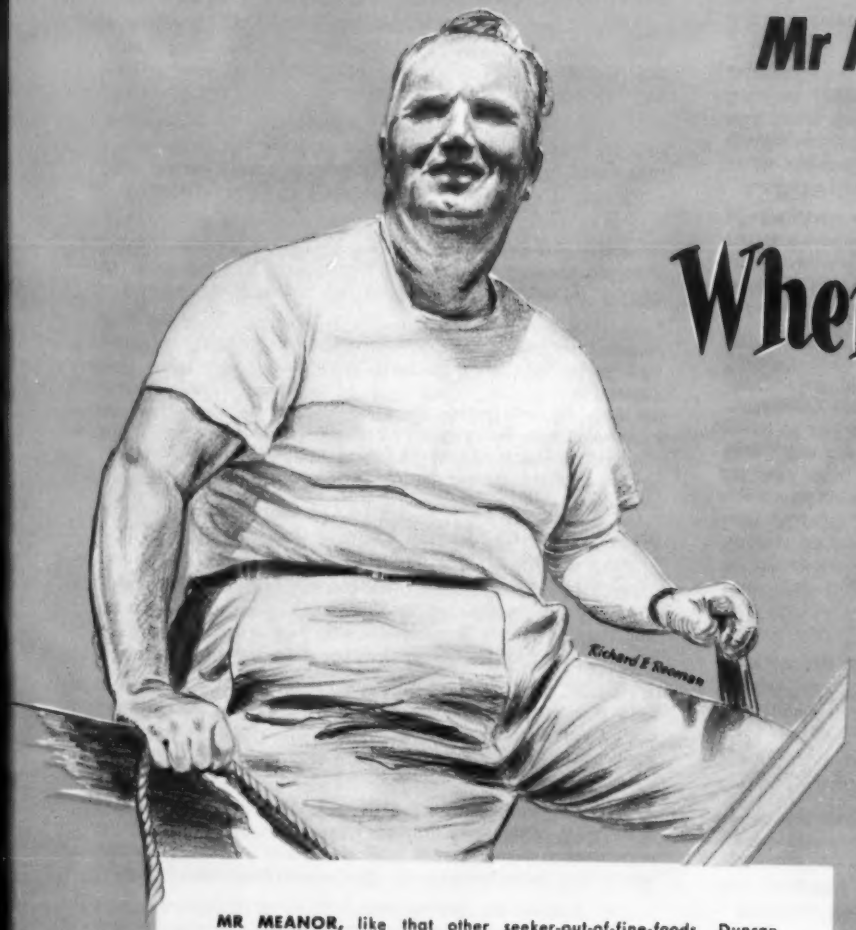


Mr Meanor's Misdemeanors for the Stout

or

Where to eat in Chicago

ANSON E MEANOR



MR MEANOR, like that other seeker-out-of-fine-foods, Duncan Hines, *knows* because he's eaten repeatedly at most of the places he lists. This picture of him in all his corpulence shows him at the tiller of his Naia II, and is the best proof we could find that he's a frequent diner-out. The wherewithal comes from his position as Chicago District Manager of our companion magazine, *Product Engineering*, although much of it was built on our time and expense account. Note that his middle initial is followed by no period. That's not only our style, but also his — he has no middle name, just an initial. He is quite as insistent about that as he is about good food.

This is a command performance. Eight years ago, when the Machine Tool Show was at the remote Dodge plant (heralded then as "the Tucker plant"—remember?), there were no restaurants nearby. Our then-Chicago-representative, Anson Meanor, a gourmet of girth, correctly surmised that visitors would have real trouble finding eating places worth finding, and that show-cafeteria fare rapidly palls. We therefore published his destined-to-be-famous "Where to Eat in Chicago."

It was, without question, the most widely distributed piece of literature at the Show, and has since enjoyed frequent reprintings by various magazines, Chicago and Milwaukee companies in all fields, and forced Mr Meanor into such opulence of figure his doctor was terrified. With the approach of this year's Show, many sources, official and personal, insisted upon a modernized listing of gustatory paradises. Here it is—a shorter list than last time because the outlying restaurants are not included, with four exceptions—one next door to the Amphitheatre and three others so notable they couldn't be left out. With these exceptions, all restaurants are less than a dollar by cab from your hotel; many can be reached by walking. They're guaranteed to add to your weight, and there is the definite possibility (duly indicated) that some will likewise fatten your expense account—or slash your personal funds, if you are incorruptible or unfortunate.

We debated whether or not to include lists of famous places (Fine Arts Museum, Field Museum, Shedd Aquarium, Adler Planetarium, et al) to visit, and night spots to approach with caution (and Chicago has plenty). Our decision was not to list either; men seeking non-Show culture or relaxation seem able to find both time and place without assistance. We have, however, added a map and explanation of central Chicago's streets.

Where to eat in Chicago

"The Fat Boys know where to find good food." Somebody said that once, and that makes me a gourmet—mine is a 41 waistline (trimmed down from 46). And most of that waistline grew right here in Chicago, at some of the most wonderful eating houses you could ever find.

Care to look over my list of favorites? When you're in Chicago attending the three tremendous shows in September, you might be happy to have this reference list handy, especially after you've walked miles around the Amphitheatre, the Navy Pier, and the Coliseum, and you suddenly want to sit down to a good and relaxing meal.

This is by no means intended to be the Complete Guide to Chicago Eating. Many good restaurants suffer omission from this list only because we haven't tried them all, and cannot personally vouch for them. So, if some friend of yours (whose taste you can trust) should recommend a restaurant not listed here, by all means find it and try it out.

Each restaurant in the following list is recommended to you on personal experience—my family, my friends, and I have tried each one on many occasions, and always found them to be reliable. You won't be sorry you have selected any of them.

Unless mentioned, all these places serve both luncheon and dinner, also liquor. I take no credit for knowing where the best breakfasts are—besides, so many of you will want only tomato juice!

We highly recommend calling for reservations everywhere. When you have made up your mind where you want to eat, take an extra minute to make reservations—it's such a kindness to your ulcers to walk into a restaurant and be shown immediately to your waiting table.

For more than ten years, I've named **The Buttery** at the Ambassador Hotel (10 E Goethe St, SUperior 7-7200) my first choice for good food in Chicago. The record still stands. Quiet, pleasant atmosphere, in addition to the excellent meals, make this place unbeatable. High-priced.

Equally good food, in more pretentious surroundings than at The Buttery, is found at **The Pump Room** in the Ambassador East Hotel, just across the street. It is at The

Conrad Hilton Hotel, Boulevard Room, 720 S Michigan Ave, WAbash 2-4400. Here, along with fine food, you'll enjoy one of the best floor shows in town . . . and this one is on ice! After the floor show, a dance floor is rolled out covering the ice. The bill runs up.

Drake Hotel, Lake Shore Drive and Michigan Ave, SUperior 7-2200. The Cape Cod Room is probably Chicago's very best place for seafood and fish. What's your pleasure? Red snapper soup? Pompano? Colorado rainbow trout? Lake Superior whitefish? Oysters? Best dish of them all is Lake Michigan perch fillets. For heaven's sake, don't ask for a steak! Costly, but sooooo good.

Don the Beachcomber, 101 E Walton St, SUperior 7-8812. Opens at 4 PM, so no lunches. If I were king, I'd COMMAND you to include this place at least once during your Chicago visit. The favorite place for connoisseurs of Cantonese cooking at its very best. And atmosphere! You'll feel you're really somewhere in the South Pacific. Skip the Scotch-and-sodas when you're at the Beachcomber—join the party and have one of those strange-sounding rum drinks. Let the waiters bring you some of the most terrific appetizers you ever ate, particularly one called Rumaki—a Chinese water chestnut, a piece of chicken liver, wrapped in bacon and broiled. Your evening will be expensive here, but well worth it. Ask for Pinky—tell him I sent ya. (He sells me Rumakis wholesale.)

Edgewater Beach Hotel, 5349 Sheridan Road, LOngbeach 1-6000. Some distance north of the Loop, but long a favorite spot of Chicago visitors, partly because of the beautiful drive out to it. The Edgewater boasts four separate and favored eating spots:

1. **The Polynesian Village,** serving Cantonese and Indian dishes and drinks. 2. Then there's the **Rib Room** doing a fabulous job with beef, and where they bring the roast beef to you on a cart. Luncheons here are for Men Only. 3. **The Charter House** features open-hearth cooking of steaks—everything cooked over charcoal—in your full view. 4. **The Yacht Club,** the oldest room of the four, has a good old reputation for seafood dishes. . . So, it's expensive!

Gibby's, 192 N Clark St, ANdover 3-8178. Many assorted favorites here, from cheese blintzes to lobster Newburg, gefüllte fish to charcoal-broiled steaks. All exceptional. A frequented spot by newspaper, radio, television, and sports personalities. Moderate in price.

Normandy House, 800 N Michigan, SUperior 7-7371. Faces the Chicago Water Tower. It is a charming place, attributable in part to the fascinating murals by artist Edgar Miller decorating the walls of the cozy Black Sheep Bar—depicting such subjects as Christopher Columbo, and the Bastard King of England. Normandy has the only bartender in town who knows how to make a champagne cocktail as it should be made—with brandy. Not expensive.

Old Heidelberg, 14 W Randolph St, FRanklin 2-1892. A large and lovely restaurant reminiscent of the place of the same name in Germany. Charm and quiet in the main dining room upstairs, gaiety and noise in the Rathskellar. Good food in both places. Under high-priced.

Palmer House. Empire Room, State and Monroe Sts, RAndolph 6-7500. Food of French and Creole flavor. Top-rate floor shows always. In the heart of the loop. High in price.

Pearson Hotel. English Room, 190 E Pearson St, SUperior 7-8200. You can spread your elbows here and enjoy a wonderfully relaxed meal in luxurious Georgian setting. Not too costly.

Pete's Est Est Est, 535 N Wells St, WHitehall 4-1535. The odd name translates from Latin, "It is, It is, It is," from an early tradition of labelling eating houses by the "Est" rating, three being tops, of course. In my opinion, they serve the best steak in the city. If you know how to pick your beef, you can go to the refrigerator and select your own entree. Not an impressive neighborhood, and the atmosphere of the place consists of bare wood floor, and bare wooden tables. I like it. Not too costly.

The Pit, 1139 N Dearborn St, DElaware 7-9479. Opens at 5 PM, so no lunches. If you're after barbecued ribs, or barbecued anything, this is the place. Moderate.

Red Star Inn, 1528 N Clark St, WHitehall 4-9637. I can't stress enough the fine meals served at this good old German restaurant. Supposed to be an exact replica of Old Heidelberg in Germany. Hungry for potato pancakes? Or hasenpfeffer? Or lentil soup? A specialty: Hoppel-poppel (a dessert). Under high-priced.

Riccardo Restaurant and Gallery, 437 N Rush St, WHitehall 4-8815. Including Chicago's only sidewalk cafe. Have a little art with your dinner—and song (singing waiters—and you too!). Cuisine is Italian, the art is varied but mostly modern. In addition to the four large and famous murals behind the bar, the restaurant's walls are always hung with paintings by outstanding Chicago artists. Sometimes they throw in an exotic photographic exhibit. You don't have to eat spaghetti to eat Italian. There are numerous other dishes, all perfectly delightful. The drinks are superb, and the prices moderate.

Ricketts, 103 E Chicago Ave, WHitehall 4-9500. Always very crowded—so make reservations for dinner especially. The food is exceptional, and you'll like the portions. Rickett's is open till 4 AM and they do a marvelous job on late-hour "snacks". Prices you can meet.

Sherman Hotel, Clark & Randolph Sts, FRanklin 2-2100. Two special rooms: **College Inn Porterhouse** serving, as you can guess, steaks of the best kind; and **Well of the Sea** serving so-good seafoods of great variety. Both quite costly.

St. Hubert's Old English Grill, 316 S Federal St, WEb-

than at The Buttery, is found at **The Pump Room** in the Ambassador East Hotel, just across the street. It is at The Pump Room that the idea of food on a flaming sword originated. Some day I'm going to ask for a hamburger on a flaming sword! Famous faces feed here, so sometimes the Room gets abuzz with names of celebrities present. Not-so-famous people are welcome, too, of course—with reservations (call SUperior 7-7200). After all, somebody has to look at those who came to be looked at! High-priced.

Barney's Market Club, 741 W Randolph St, ANdover 3-9795. Absolutely no atmosphere. Just wonderful food! And such heaping portions. Steaks, steaks, steaks, and here and there a chop or a rib. You'll love it, and the price isn't high.

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Binyon's, 327 S Plymouth Ct, WEbster 9-8498. When you want a not-fancy, not-expensive, plain-cooking kind of place, you want Binyon's. German-style meals. They take special pains with game dishes. I emphatically recommended Binyon's—it's very high-grade and far from expensive.

Bismarck Hotel, 171 W Randolph St, CEntral 6-0123. **The Swiss Chalet** at the Bismarck is about as unique a restaurant as you'll find. You just don't see many places of Swiss decor. Yodelers and Alpine music, too. Very high-grade cooking, Germanic style. This includes tongue-twisters like Schnitzel Emmenthal, wiener backhuhn, and a specialty of the house: zwiebelkuchen. Your bill will run up only because you won't be able to resist anything, especially the Swiss Napoleon cake for dessert.

A Bit of Sweden, 1015 Rush St, DElaware 7-1492. For many years has remained the favorite place of connoisseurs of Swedish cookery. Superb smorgasbord. Under high-priced.

Black Orchid, 101 E Ontario St, MOhawk 4-6666. One of the newest places in town, it has quickly acquired a good reputation for fine food and evening entertainment. At luncheon they feature the Chuck Wagon buffet—eat all you want for $1.35. (They lose money on me.)

Blackhawk Restaurant, 139 N Wabash Ave, RAndolph 6-2822. You may remember this as a popular night club—it's been transformed into a dining room only. Well, with a bar. Some of the best ribs and roast beef available. You'll like the prices, too.

Boston Oyster House, 21 S Clark St, FRanklin 2-9600. Chicago's oldest seafood restaurant, retains its early high reputation, and serves steaks, chops, and fowls of top quality as well. Moderately priced.

Boveri Italian Restaurant, 20 E Lake St, ANdover 3-8155. Very fine Italian food. Setting is not pretentious, prices moderate. Right on the north edge of the Loop.

Cafe Bohemia, 138 S Clinton St, ANdover 3-8310. Specialists in game cookery, seafood, beef dishes. The menu makes heavy reading—it boasts over 50 entrees. Old world atmosphere. Medium-priced.

Cafe de Paris, 1260 N Dearborn St, WHitehall 4-5620. Opens 5 PM. Chicago certainly has its share of swanky places, and it's impossible to list them in order of preference. One you should certainly include is the Cafe de Paris. French cooking (should really say cuisine here) and served in the elegant manner. Excellent, exact, expensive. Specialty is crepes suzette—it seems they never stop making them.

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Irelands, 632 N Clark, DElaware 7-2020. One of Chicago's oldest and best known seafood specialty houses. If it swims, they've got it—I'll bet they even serve tropical fish (on a flaming sword, maybe?). Nothing but seafood. Don't embarrass me be asking for a hamburger! The open kitchen fascinates many. You can watch them fix your dish. Here's one place that does not accept reservations! The bill will not floor you.

Isbell's, 940 N Rush St, DElaware 7-3500. Honest-to-goodness American cooking. And who counts calories? Good service, pleasant surroundings. Medium-priced.

Ivanhoe, 3000 N Clark St, GRaceland 2-2771. Unique and congenial place—good fun! Old English in decor and cuisine. Food is topnotch. Everyone should visit the catacombs—these are different; they have seven bars! And other surprises! You can afford this place, too.

Jacques French Restaurant, 900 N Michigan Ave, DElaware 7-9040. Only a very few places in Chicago have outdoor patios—Jacques' is probably the best known, and the nicest. Indoor dining as well, however. Wherever you choose to sit, you'll enjoy excellent French cooking. Women are especially impressed with Jacques. Costly.

Kungsholm, 100 E Ontario St, WHitehall 4-2700. Now if you REALLY want to impress someone, make it Kungsholm for luncheon or dinner. Most gorgeous array of smorgasbord anywhere, though you may have a full-course dinner instead. And, they have just about the best Martini in town. A few years ago Kungsholm was completely destroyed by fire, has since been rebuilt into far and away the most beautiful restaurant you've ever seen. The fire also destroyed the puppets, wardrobe, and stage of the famous Kungsholm Puppet Opera. It is now completely restored and operating to packed houses again. Restaurant patrons making reservations a day or so in advance may see the Puppet Grand Opera after dinner. Really something to see. Rather high-priced.

Lenard's Restaurant, 1307 N Milwaukee Ave, HUmbolt 6-5614. Here's the place for Polish cooking. Flaming shashlyk is their specialty—marinated tenderloin pieces, tomatoes, and onions on a skewer, brought to your table aflame. Lots of sour-cream-sauce dishes. Moderate.

Le Petit Gourmet, 619 N Michigan Ave, SUperior 7-1184. Look carefully, you might miss the entrance to this quaint restaurant. You have to walk through the arch and down the stairs, one flight. Smallish place, quiet, delightful. Especially tasty food, fine drinks. Easy on the

Sea serving 38-good seafoods of great variety. Bout quite costly.

St. Hubert's Old English Grill, 316 S Federal St, WEbster 9-8770. This is it—the most expensive place in Chicago. Lots of Old World English charm in evidence: oak panelled walls, red-coated waiters, glass-bottomed pewter mugs. Have a 3-in. mutton chop, or the roast beef or lobster. Imported ale. Have plenty of time when you eat here, enjoy every bite with the atmosphere. Have a well-stocked wallet, as well.

Stockyards Inn—Sirloin Room, 4178 S Halsted St, YArds 7-5580. If you're lucky, you may be able to get in this wonderful room and have yourself some of the city's best steaks and chops, ribs, and roasts right here where the stuff is born. **The Matador Room** of Spanish decor, inspired by owner William Wood Prince's recent trip to Spain, is equally difficult to get into. Keep trying. The food is equally good, with Spanish touches. Neither are the most expensive.

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Wrigley Bldg Restaurant, 410 N Michigan Ave, WHitehall 4-7600. You haven't lived until you've eaten here. Very difficult to get reservations. *Truly,* the very best Martini in town. You could choose from the menu with your eyes closed and be perfectly pleased with your entire meal. They have a knack for doing what is right to a fish, especially Lake Superior Whitefish. And they have a way with pan-broiling that is terrific. Chocolate Chip Sundae is the best. Very reasonably priced.

Ye Old Cellar, 322 N Michigan Ave, DEarborn 2-2727. Large room with a good bar in the center. A good spot for lunches and dinners and late evening filler-uppers. Music and dancing in the evenings. Full menu, with lots of attention paid to steaks and chops. Prices fine.

Now—if you are completely confused, let's narrow it down to my top personal choices—in the order previously mentioned, here they are: Buttery, Binyon's, Cafe Bohemia, Don the Beachcomber, Charter House, Kungsholm, Pete's Est Est Est, Red Star Inn, St Hubert's Old English Grill, Wrigley Building Restaurant.

You will weigh more when you leave Chicago.

Pecuniary note to walk up an appetite

In this list are 47 eating places of distinction, 16 in the Loop area, 21 others not more than a mile by taxi. From the average of Loop hotels, four others are 1½ miles ($0.65 by cab), two are 2 miles ($0.75 by cab), one is 2½

most wonderful eating houses you could ever find.

Care to look over my list of favorites? When you're in Chicago attending the three tremendous shows in September, you might be happy to have this reference list handy, especially after you've walked miles around the Amphitheatre, the Navy Pier, and the Coliseum, and you suddenly want to sit down to a good and relaxing meal.

This is by no means intended to be the Complete Guide to Chicago Eating. Many good restaurants suffer omission from this list only because we haven't tried them all, and cannot personally vouch for them. So, if some friend of yours (whose taste you can trust) should recommend a restaurant not listed here, by all means find it and try it out.

Each restaurant in the following list is recommended to you on personal experience—my family, my friends, and I have tried each one on many occasions, and always found them to be reliable. You won't be sorry you have selected any of them.

Unless mentioned, all these places serve both luncheon and dinner, also liquor. I take no credit for knowing where the best breakfasts are—besides, so many of you will want only tomato juice!

We highly recommend calling for reservations everywhere. When you have made up your mind where you want to eat, take an extra minute to make reservations—it's such a kindness to your ulcers to walk into a restaurant and be shown immediately to your waiting table.

For more than ten years, I've named **The Buttery** at the Ambassador Hotel (10 E Goethe St, SUperior 7-7200) my first choice for good food in Chicago. The record still stands. Quiet, pleasant atmosphere, in addition to the excellent meals, make this place unbeatable. High-priced.

Equally good food, in more pretentious surroundings than at The Buttery, is found at **The Pump Room** in the Ambassador East Hotel, just across the street. It is at The Pump Room that the idea of food on a flaming sword originated. Some day I'm going to ask for a hamburger on a flaming sword! Famous faces feed here, so sometimes the Room gets abuzz with names of celebrities present. Not-so-famous people are welcome, too, of course—with reservations (call SUperior 7-7200). After all, somebody has to look at those who came to be looked at! High-priced.

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covering the ice. The bill runs up.

Drake Hotel, Lake Shore Drive and Michigan Ave, SUperior 7-2200. The Cape Cod Room is probably Chicago's very best place for seafood and fish. What's your pleasure? Red snapper soup? Pompano? Colorado rainbow trout? Lake Superior whitefish? Oysters? Best dish of them all is Lake Michigan perch fillets. For heaven's sake, don't ask for a steak! Costly, but sooooo good.

Don the Beachcomber, 101 E Walton St, SUperior 7-8812. Opens at 4 PM, so no lunches. If I were king, I'd COMMAND you to include this place at least once during your Chicago visit. The favorite place for connoisseurs of Cantonese cooking at its very best. And atmosphere! You'll feel you're really somewhere in the South Pacific. Skip the Scotch-and-sodas when you're at the Beachcomber—join the party and have one of those strange-sounding rum drinks. Let the waiters bring you some of the most terrific appetizers you ever ate, particularly one called Rumaki—a Chinese water chestnut, a piece of chicken liver, wrapped in bacon and broiled. Your evening will be expensive here, but well worth it. Ask for Pinky —tell him I sent ya. (He sells me Rumakis wholesale.)

Edgewater Beach Hotel, 5349 Sheridan Road, LOngbeach 1-6000. Some distance north of the Loop, but long a favorite spot of Chicago visitors, partly because of the beautiful drive out to it. The Edgewater boasts four separate and favored eating spots:

1. The Polynesian Village, serving Cantonese and Indian dishes and drinks. 2. Then there's the **Rib Room** doing a fabulous job with beef, and where they bring the roast beef to you on a cart. Luncheons here are for Men Only. 3. **The Charter House** features open-hearth cooking of steaks—everything cooked over charcoal—in your full view. 4. **The Yacht Club,** the oldest room of the four, has a good old reputation for seafood dishes. . . So, it's expensive!

Gibby's, 192 N Clark St, ANdover 3-8178. Many assorted favorites here, from cheese blintzes to lobster Newburg, gefüllte fish to charcoal-broiled steaks. All exceptional. A frequented spot by newspaper, radio, television, and sports personalities. Moderate in price.

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Edgar Miller decorating the walls of the cozy Black Sheep Bar—depicting such subjects as Christopher Columbo, and the Bastard King of England. Normandy has the only bartender in town who knows how to make a champagne cocktail as it should be made—with brandy. Not expensive.

Old Heidelberg, 14 W Randolph St, FRanklin 2-1892. A large and lovely restaurant reminiscent of the place of the same name in Germany. Charm and quiet in the main dining room upstairs, gaiety and noise in the Rathskellar. Good food in both places. Under high-priced.

Palmer House. Empire Room, State and Monroe Sts, RAndolph 6-7500. Food of French and Creole flavor. Top-rate floor shows always. In the heart of the loop. High in price.

Pearson Hotel. English Room, 190 E Pearson St, SUperior 7-8200. You can spread your elbows here and enjoy a wonderfully relaxed meal in luxurious Georgian setting. Not too costly.

Pete's Est Est Est, 535 N Wells St, WHitehall 4-1535. The odd name translates from Latin, "It is, It is, It is," from an early tradition of labelling eating houses by the "Est" rating, three being tops, of course. In my opinion, they serve the best steak in the city. If you know how to pick your beef, you can go to the refrigerator and select your own entree. Not an impressive neighborhood, and the atmosphere of the place consists of bare wood floor, and bare wooden tables. I like it. Not too costly.

The Pit, 1139 N Dearborn St, DElaware 7-9479. Opens at 5 PM, so no lunches. If you're after barbecued ribs, or barbecued anything, this is the place. Moderate.

Red Star Inn, 1528 N Clark St, WHitehall 4-9637. I can't stress enough the fine meals served at this good old German restaurant. Supposed to be an exact replica of Old Heidelberg in Germany. Hungry for potato pancakes? Or hasenpfeffer? Or lentil soup? A specialty: Hoppel-poppel (a dessert). Under high-priced.

Riccardo Restaurant and Gallery, 437 N Rush St, WHitehall 4-8815. Including Chicago's only sidewalk cafe. Have a little art with your dinner—and song (singing waiters—and you too!). Cuisine is Italian, the art is varied but mostly modern. In addition to the four large and famous murals behind the bar, the restaurant's walls are always hung with paintings by outstanding Chicago artists. Sometimes they throw in an exotic photographic exhibit. You don't have to eat spaghetti to eat Italian. There are numerous other dishes, all perfectly delightful. The drinks are superb, and the prices moderate.

Ricketts, 103 E Chicago Ave, WHitehall 4-9500. Always very crowded—so make reservations for dinner especially. The food is exceptional, and you'll like the portions. Rickett's is open till 4 AM and they do a marvelous job on late-hour "snacks". Prices you can meet.

Sherman Hotel, Clark & Randolph Sts, FRanklin 2-2100. Two special rooms: **College Inn Porterhouse** serving, as you can guess, steaks of the best kind; and **Well of the Sea** serving so-good seafoods of great variety. Both quite costly.

St. Hubert's Old English Grill, 316 S Federal St, WEbster 9-8770. This is it—the most expensive place in Chicago. Lots of Old World English charm in evidence: oak panelled walls, red-coated waiters, glass-bottomed pewter mugs. Have a 3-in. mutton chop, or the roast beef or lobster. Imported ale. Have plenty of time when you eat here, enjoy every bite with the atmosphere. Have a well-stocked wallet, as well.

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Chez Paul, 180 E Delaware St, DElaware 7-9713. I've never been to France, but this place makes me feel I'm there. From appetizer to entree to dessert you won't make a mistake, I guarantee. Expensive.

Club El Bianco, 2747 W 63rd St, REpublic 7-2662. Here's another Italian restaurant well worth the trip to its out-of-the-Loop location. Multi-course Italian dinner, all very delectable. Higher than moderate.

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Murice's Restaurant, 173 W Madison St, DEarborn 2-2233. Jewish-American. Sort of international in its cuisine, including smorgasbord, Danish pastries, Creole shrimps, and blintzes! (Not all in one meal, please!) You'll have no trouble finding your favorites on their large and varied menu. And moderate in price.

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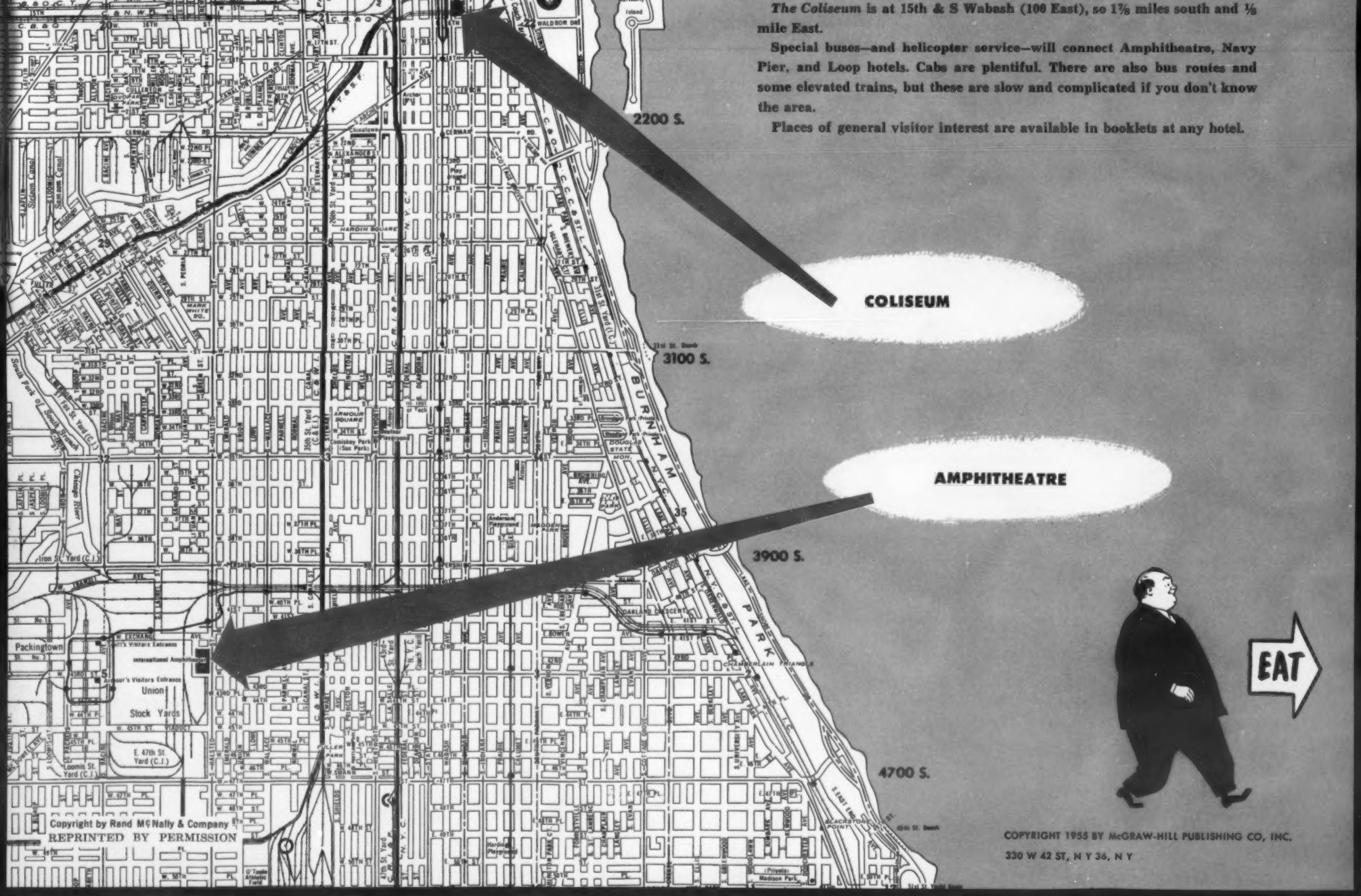
In this list are 47 eating places of distinction, 16 in the Loop area, 21 others not more than a mile by taxi. From the average of Loop hotels, four others are 1½ miles ($0.65 by cab), two are 2 miles ($0.75 by cab), one is 2½ miles ($0.85). Stockyards Inn is 6 miles ($1.55 by cab—but right at the Amphitheatre), Edgewater Beach is 7 miles ($1.75 by cab), Club El Bianco 11 miles ($2.15 by cab). Chicago taxi rates are 35 cents for the first quarter mile, 10 cents for each additional half mile, and there are the usual waits for lights to add. Thus, 44 of the 47 are under a dollar for cab for one person (plus 10 cents for each added person).

The Coliseum is at 15th & S Wabash (100 East), so 1⅞ miles south and ⅛ mile East.

Special buses—and helicopter service—will connect Amphitheatre, Navy Pier, and Loop hotels. Cabs are plentiful. There are also bus routes and some elevated trains, but these are slow and complicated if you don't know the area.

Places of general visitor interest are available in booklets at any hotel.



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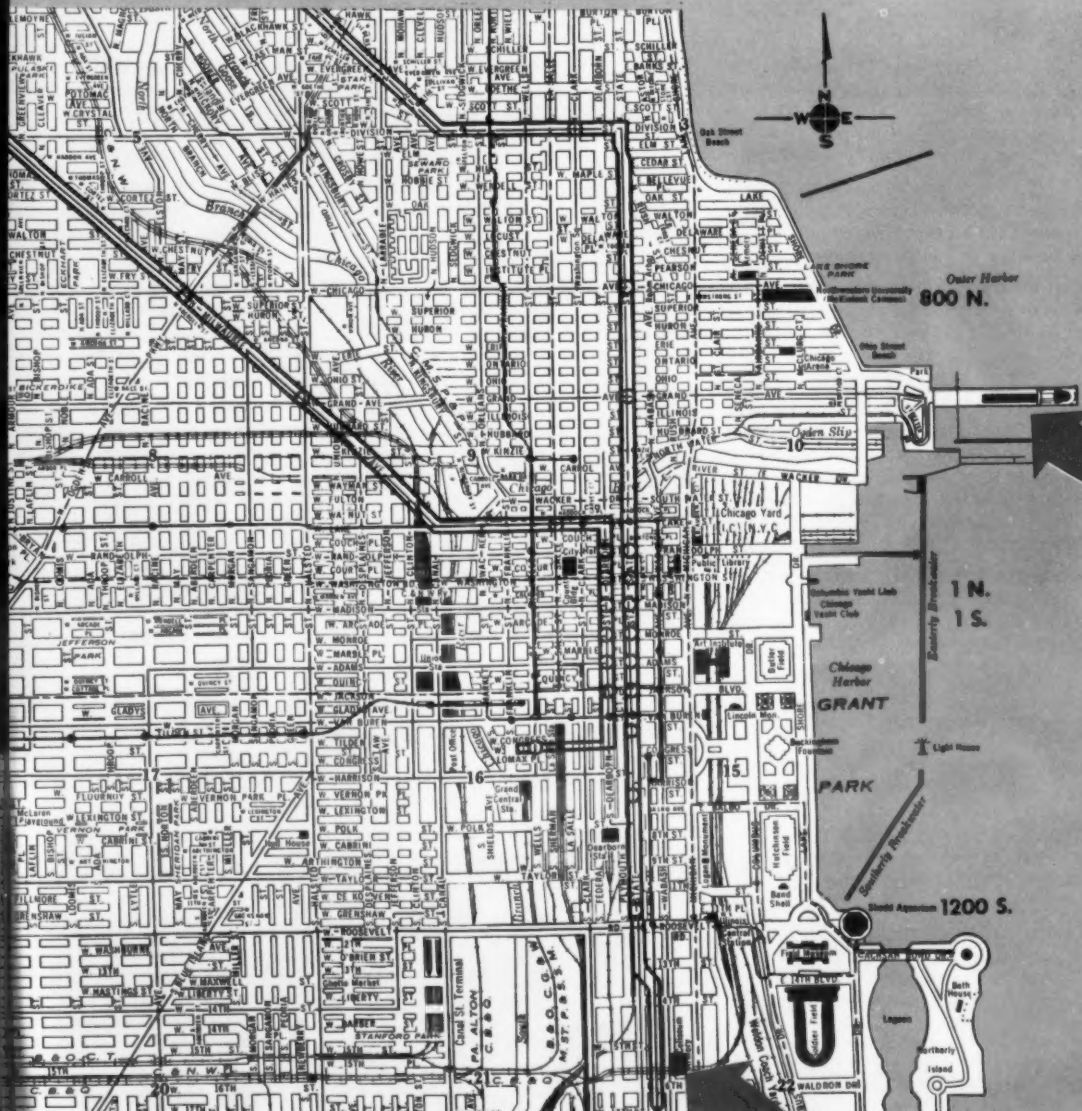


You can't get lost in Chicago — IF . . .

Before you learn where to eat, you'd better know how to get there. The city is easy to find your way around. All numbers start at "the busiest corner in the world"—State & Madison—East and West numbers from State Street, North and South numbers from Madison. With few exceptions, Chicago's streets run exactly north and south, or east and west. There are 800 numbers to the mile. All numbered streets are on the South Side. And Lake Michigan is always to the east. That's all you really need to know.

Halsted Street is 800 West, so a mile west of State. 43rd Street is 3⅞ miles south of Madison. *The Amphitheatre* is at 43rd & Halsted.

***The Navy Pier* is at the foot of Grand Ave (500 North) and the foot of the pier is 300 East.**

***The Coliseum* is at 15th & S Wabash (100 East), so 1⅞ miles south and ⅛ mile East.**

Where to eat in Chicago

"The Fat Boys know where to find good food." Somebody said that once, and that makes me a gourmet—mine is a 41 waistline (trimmed down from 46). And most of that waistline grew right here in Chicago, at some of the most wonderful eating houses you could ever find.

Care to look over my list of favorites? When you're in Chicago attending the three tremendous shows in September, you might be happy to have this reference list handy, especially after you've walked miles around the Amphitheatre, the Navy Pier, and the Coliseum, and you suddenly want to sit down to a good and relaxing meal.

This is by no means intended to be the Complete Guide to Chicago Eating. Many good restaurants suffer omission from this list only because we haven't tried them all, and cannot personally vouch for them. So, if some friend of yours (whose taste you can trust) should recommend a restaurant not listed here, by all means find it and try it out.

Each restaurant in the following list is recommended to you on personal experience—my family, my friends, and I have tried each one on many occasions, and always found them to be reliable. You won't be sorry you have selected any of them.

Unless mentioned, all these places serve both luncheon and dinner, also liquor. I take no credit for knowing where the best breakfasts are—besides, so many of you will want only tomato juice!

We highly recommend calling for reservations everywhere. When you have made up your mind where you want to eat, take an extra minute to make reservations—it's such a kindness to your ulcers to walk into a restaurant and be shown immediately to your waiting table.

For more than ten years, I've named **The Buttery** at the Ambassador Hotel (10 E Goethe St, SUperior 7-7200) my first choice for good food in Chicago. The record still stands. Quiet, pleasant atmosphere, in addition to the excellent meals, make this place unbeatable. High-priced.

Conrad Hilton Hotel, Boulevard Room, 720 S Michigan Ave, WAbash 2-4400. Here, along with fine food, you'll enjoy one of the best floor shows in town . . . and this one is on ice! After the floor show, a dance floor is rolled out covering the ice. The bill runs up.

Drake Hotel, Lake Shore Drive and Michigan Ave, SUperior 7-2200. The Cape Cod Room is probably Chicago's very best place for seafood and fish. What's your pleasure? Red snapper soup? Pompano? Colorado rainbow trout? Lake Superior whitefish? Oysters? Best dish of them all is Lake Michigan perch fillets. For heaven's sake, don't ask for a steak! Costly, but sooooo good.

Don the Beachcomber, 101 E Walton St, SUperior 7-8812. Opens at 4 PM, so no lunches. If I were king, I'd COMMAND you to include this place at least once during your Chicago visit. The favorite place for connoisseurs of Cantonese cooking at its very best. And atmosphere! You'll feel you're really somewhere in the South Pacific. Skip the Scotch-and-sodas when you're at the Beachcomber—join the party and have one of those strange-sounding rum drinks. Let the waiters bring you some of the most terrific appetizers you ever ate, particularly one delectable. Higher than moderate.

large and varied menu. And moderate in price.

Normandy House, 800 N Michigan, SUperior 7-7371. Faces the Chicago Water Tower. It is a charming place, attributable in part to the fascinating murals by artist Edgar Miller decorating the walls of the cozy Black Sheep Bar—depicting such subjects as Christopher Columbo, and the Bastard King of England. Normandy has the only bartender in town who knows how to make a champagne cocktail as it should be made—with brandy. Not expensive.

Old Heidelberg, 14 W Randolph St, FRanklin 2-1892. A large and lovely restaurant reminiscent of the place of the same name in Germany. Charm and quiet in the main dining room upstairs, gaiety and noise in the Rathskellar. Good food in both places. Under high-priced.

Palmer House. Empire Room, State and Monroe Sts, RAndolph 6-7500. Food of French and Creole flavor. Top-rate floor shows always. In the heart of the loop. High in price.

Pearson Hotel. English Room, 190 E Pearson St, SUperior 7-8200. You can spread your elbows here and enjoy a wonderfully relaxed meal in luxurious Georgian setting. Not too costly.

Pete's Est Est Est, 535 N Wells St, WHitehall 4-1535. The odd name translates from Latin, "It is, It is, It is," from an early tradition of labelling eating houses by the "Est" rating, three being tops, of course. In my opinion, they serve the best steak in the city. If you know how to pick your beef, you can go to the refrigerator and select your own entree. Not an impressive neighborhood, and the atmosphere of the place consists of bare wood floor, and bare wooden tables. I like it. Not too costly.

The Pit, 1139 N Dearborn St, DElaware 7-9479. Opens at 5 PM, so no lunches. If you're after barbecued ribs, or barbecued anything, this is the place. Moderate.

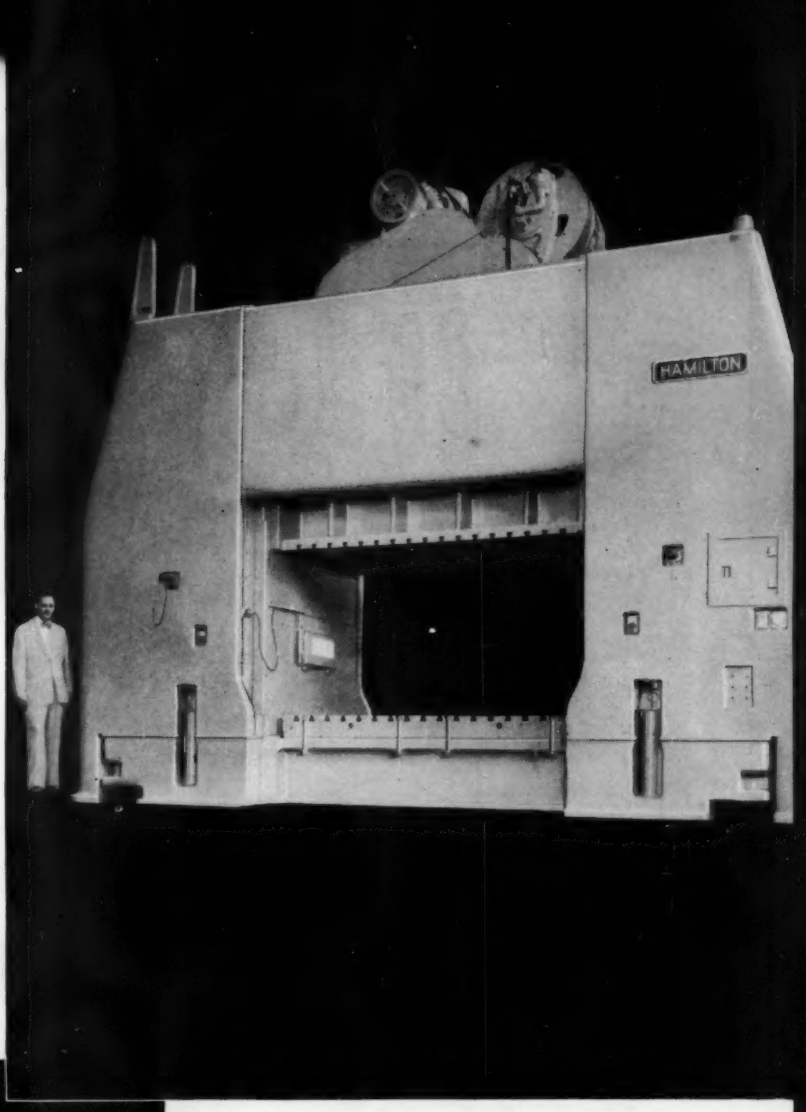
Red Star Inn, 1528 N Clark St, WHitehall 4-9637. I can't stress enough the fine meals served at this good old German restaurant. Supposed to be an exact replica of Old Heidelberg in Germany. Hungry for potato pancakes? Or hasenpfeffer? Or lentil soup? A specialty: Hoppel- for each added person).

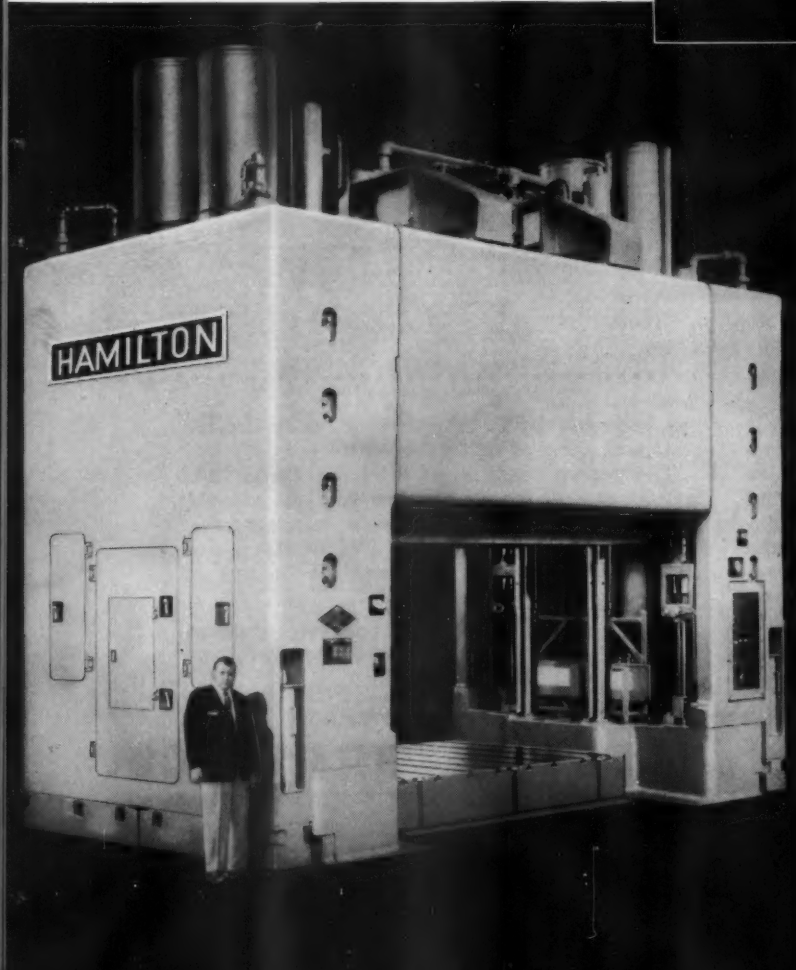
Ready for Delivery...

HAMILTON Presses

Now you can increase your productive capacity without delay. These Hamilton presses are in stock, as well as other single action, double action and triple action presses.

Hamilton's new unique policy of building these standard presses for stock means a sound investment for you. You'll profit by acting right away.



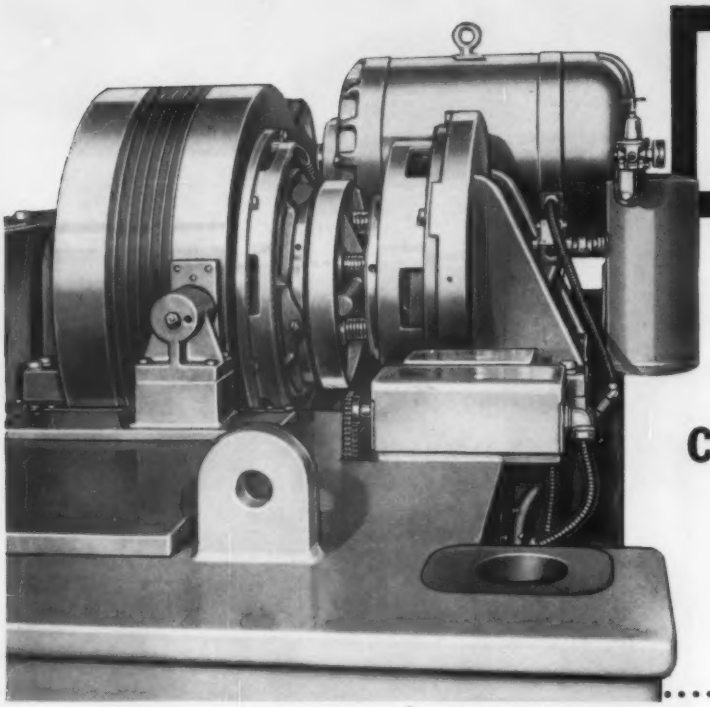


Like to get details on these available presses? Just pick up your phone and call Hamilton Division, Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio.

BALDWIN BLH LIMA-HAMILTON

Hamilton Division

BALDWIN-LIMA-HAMILTON



These are the features **that make -Verson- presses your best buy**

THE Verson CLUTCH AND BRAKE UNIT

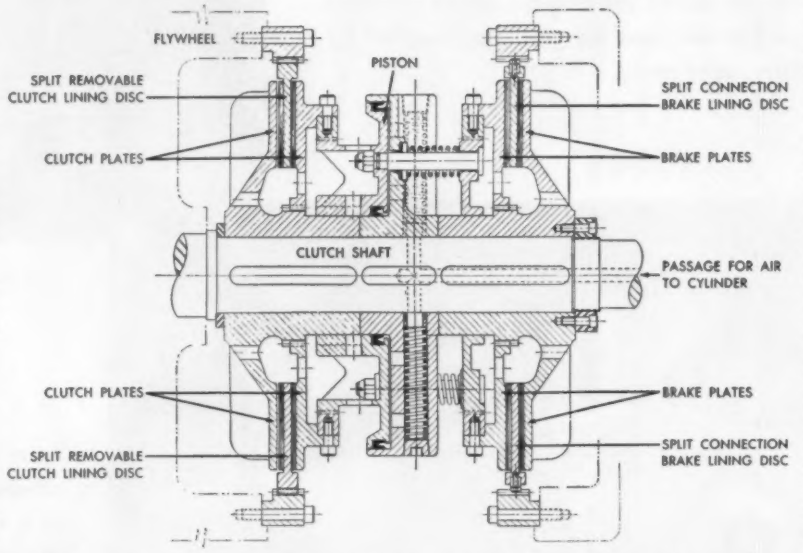
No tricks— just top notch performance

The drawing at the right shows the construction and operation of the Verson clutch and brake unit.

With the clutch disengaged, powerful brake springs clamp brake plates against the stationary brake disc. The brake disc is mounted to the press frame in a manner that will permit axial motion but will oppose rotation.

To engage the clutch, air is admitted to the operating cylinder through a passage in the drive shaft. This forces the piston out, compressing the brake springs and releasing the brake. Further motion of the piston engages the clutch thereby transmitting the motion of the flywheel to the clutch shaft.

When air pressure in the operating cylinder is released, the brake springs pull the piston back, first disengaging the clutch and then engaging the brake.



The Verson Pneumatic Clutch and Brake Unit is the heart of Verson mechanical presses. It is a mechanically interlocked type which eliminates all possibility of overlap between clutch and brake. Drag cannot occur, efficient power application is assured and wear on clutch and brake linings is minimized. Shock and vibration are also minimized for longer press life. This is no trick clutch . . . it is a soundly designed unit that has been proved in countless hours of abusive tests and years of field experience.

The Verson Pneumatic Clutch and Brake Unit is just one of many reasons why it pays to specify Verson Presses for your requirements. We'll be happy to tell you the whole story. For specific recommendations, send an outline of your requirements.

Ask us about our new customized installment and leasing programs.

A Verson Press for every job from 60 tons up.

Verson

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DIAMOND LOCATING PINS...I

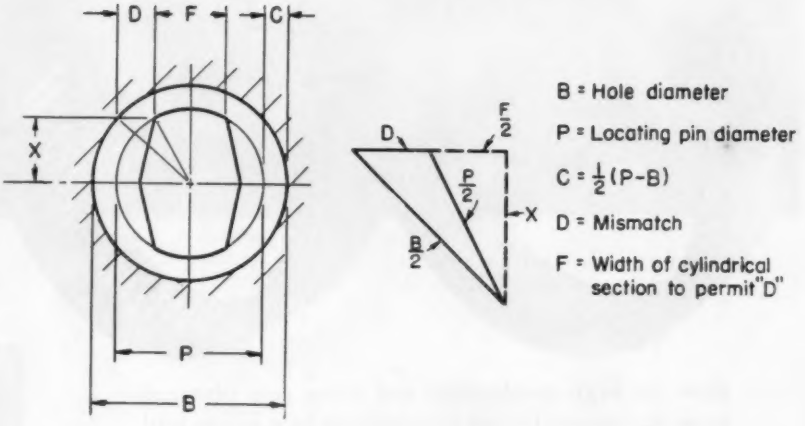
RUDOLPH GREENBERG, Equipment Engineering, Lamp Division
WESTINGHOUSE ELECTRIC CORPORATION, BLOOMFIELD, NJ

When a part must be located from two holes for subsequent machining operations, it is always a problem how best to dimension the locating holes, the two locating pins and their center distance.

One solution is by holding hole diameters and the center distance in the part to close tolerances, to do the same with the locating fixture, and to make one of the locating pins undersize to take care of variations. Such procedure is expensive, especially when the part itself does not require such extreme accuracy.

While it is comparatively simple to machine a hole to a tolerance of ± 0.0005 in., it is more difficult to hold a center distance to such limits on a production basis. For example, when production-drilled and reamed holes are held to tolerances of ± 0.0005 in., with tolerances of ± 0.005 on center distance, and the locating fixture has a center distance tolerance of ± 0.001 in., the total mismatch would be ± 0.006 in. A round pin then must be 0.012 in. undersize to meet possible variations.

Substitution of a diamond-shaped pin for the undersized round locating pin makes it possible to reduce this error considerably. One now uses to best advantage the easily maintained close hole diameter, and minimizes the effect of generous tolerance for the center distance. A diamond shape is recommended because it results in a stronger pin. If high strength is not necessary, two parallel flats a distance F apart will have the same effect and are less difficult to produce. It should be noted, however, that the centerline bisecting F must be at right angles to the center distance between the two locating pins.



The mathematical relationships between B, the hole diameter, locating pin diameter P and the amount of mismatch D can easily be determined, giving the equation for the nomogram, page 13.

The derivation is:

$$X^2 = \left(\frac{B}{2}\right)^2 - \left(\frac{F}{2} + D\right)^2$$

$$X^2 = \left(\frac{P}{2}\right)^2 - \left(\frac{F}{2}\right)^2$$

Then $\left(\frac{P}{2}\right)^2 - \left(\frac{F}{2}\right)^2 =$

$$\left(\frac{B}{2}\right)^2 - \left(\frac{F}{2}\right)^2 - FD - D^2$$

$$FD = \left(\frac{B}{2}\right)^2 - \left(\frac{P}{2}\right)^2 - D^2$$

$$FD = \frac{B^2 - P^2 - 4D^2}{4}$$

Because $B = P + 2C$

$$F = \frac{C}{D}(P + C) - D$$

For a simple nomographic presentation the above equation can be written:

$$F + D = \frac{C}{D}(P + C)$$

Because F cannot be larger than P, the maximum value of $\frac{C}{D}$ will be 1.

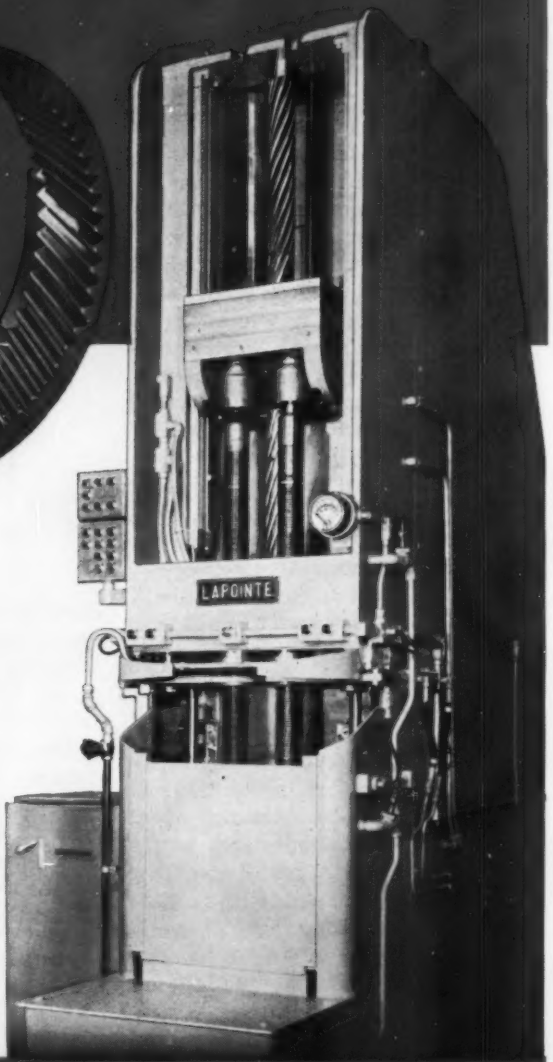
When using the nomogram, the value C may be omitted in the column $(P + C)$ without significantly altering the result.

This nomogram can also be used for the correction of binding of machine elements that slide over two round bars which have a fixed center distance.

BROACHING without CHATTER

is easy, on the LAPOINTE VUE-7

the world's first **ELECTRO-MOTIVE POWERED**
pull-up **BROACHING MACHINE**



Built for high production, and using two identical broaches rotated in true synchronism by a sturdy lead bar, this new LAPOINTE machine broaches **helical internal gear automotive parts** two at a time, at a rate of 320 parts per hour . . . at 80% efficiency!

No wonder that it **broaches without chatter:** it has massive, quiet gears . . . a heavy, rigid frame . . . and electro-motive drive! No wonder, either, that because of these features the work is more accurate, and tool life is increased 400% to 500% between grinds!

LAPOINTE VUE-7

for broaching speeds of 10 to 100 feet-per-minute.

Can be built in other types and sizes up to 50 tons.

Send today for literature. Ask for Bulletin **VUE-7-2.**

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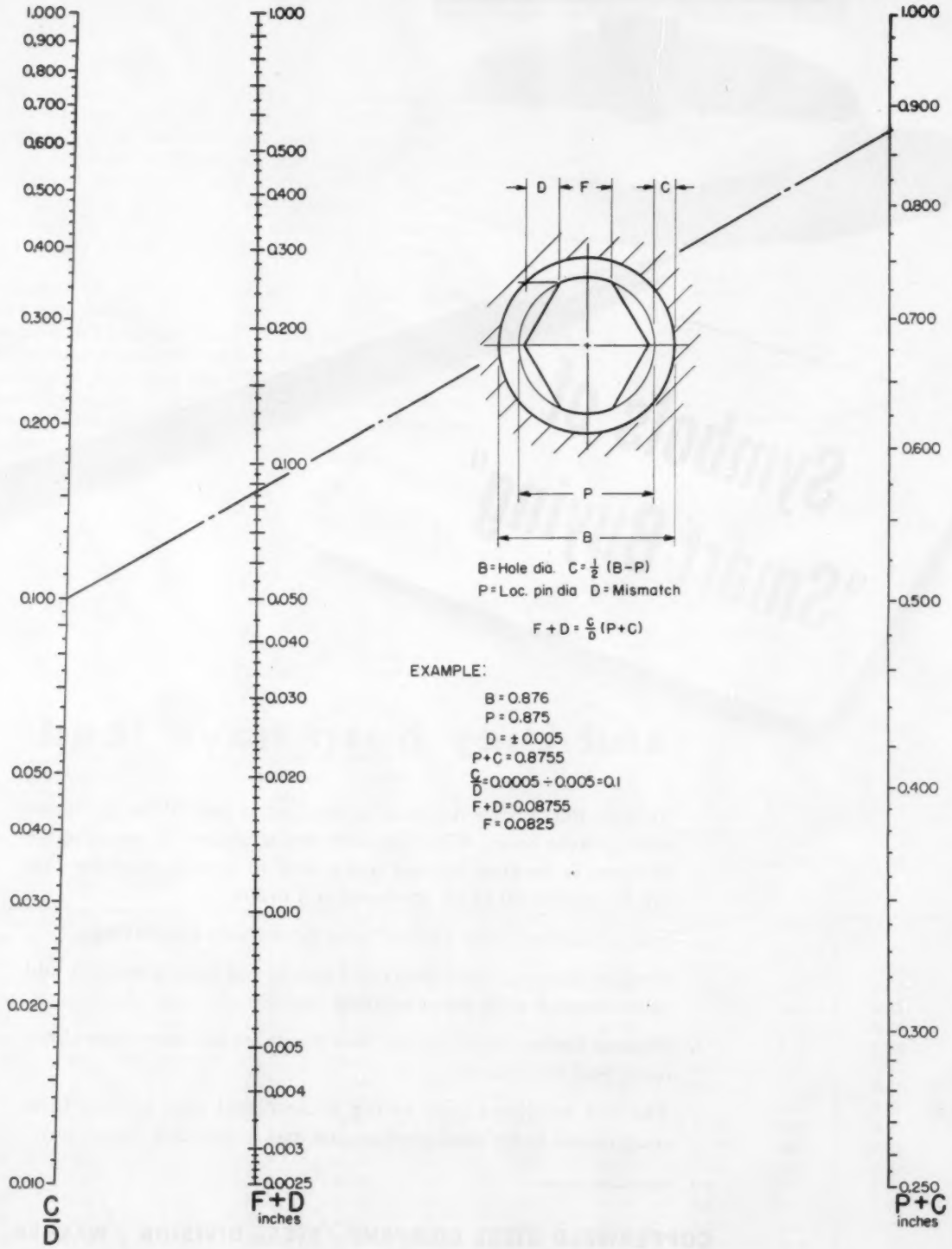
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

DIAMOND LOCATING PINS...II



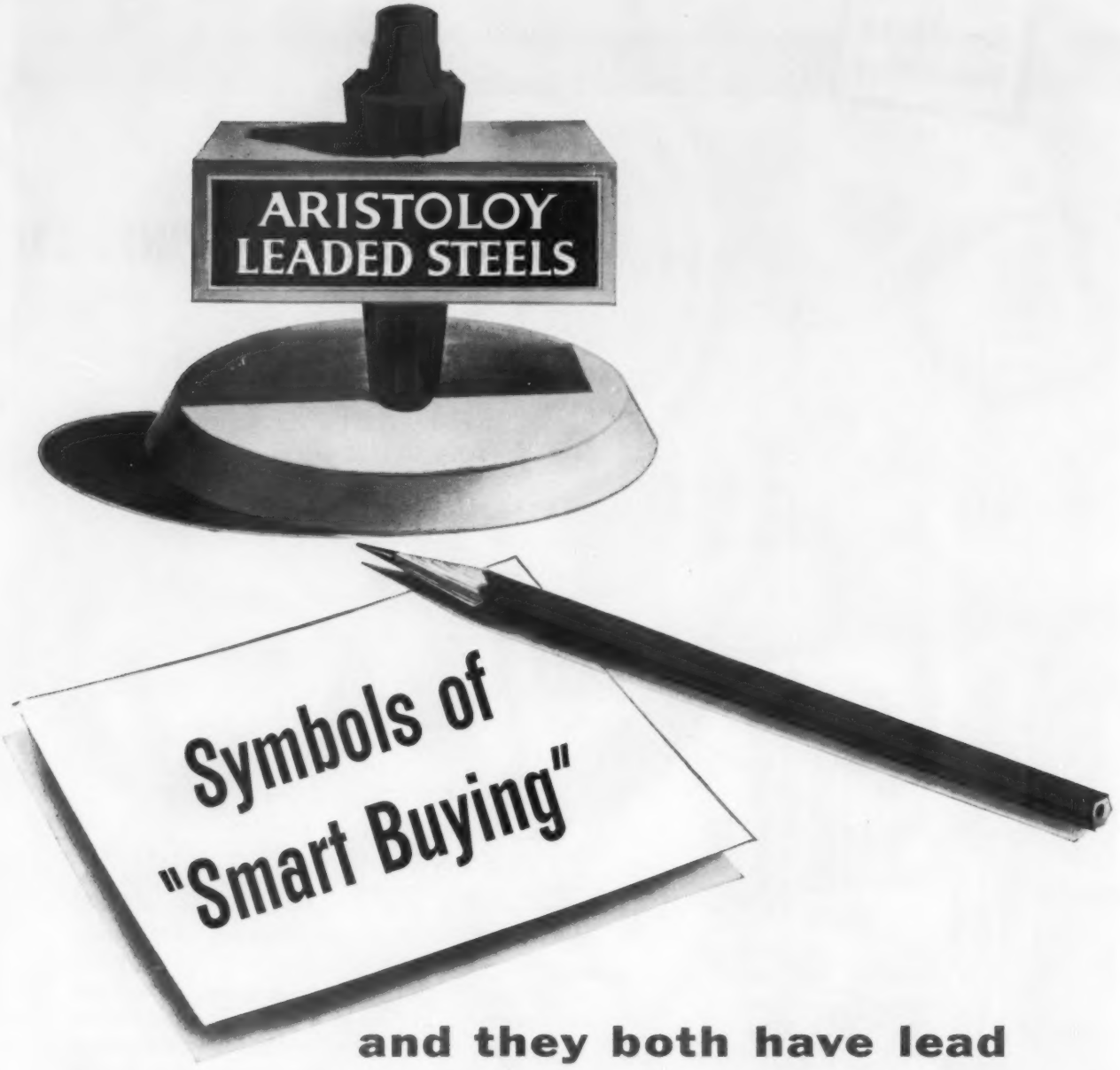
B = Hole dia. $C = \frac{1}{2}(B-P)$

P = Loc. pin dia D = Mismatch

$F + D = \frac{C}{D}(P+C)$

EXAMPLE:

B = 0.876
P = 0.875
D = ± 0.005
P+C = 0.8755
$\frac{C}{D} = 0.0005 \div 0.005 = 0.1$
F+D = 0.08755
F = 0.0825



and they both have lead

Today's Purchasing Agent is recognized as part of the executive management team. Why? Because the modern PA, using value analysis, is looking beyond initial cost to specify products that can be purchased to be produced at a profit.

Parts machined from Ledloy* give production line savings.

Freer machining, faster feeds and speeds and longer tool life add value through each manufacturing step.

Because Ledloy cuts clean for finer finish, its use sometimes eliminates final machining.

The end result—a total saving accumulated step by step from rough stock to finished product that makes Ledloy a "smart buy."

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COPPERWELD STEEL COMPANY / STEEL DIVISION / WARREN, OHIO

HOW TO MILL A LARGER RADIUS THAN CUTTER'S

LAURENCE P HERRON

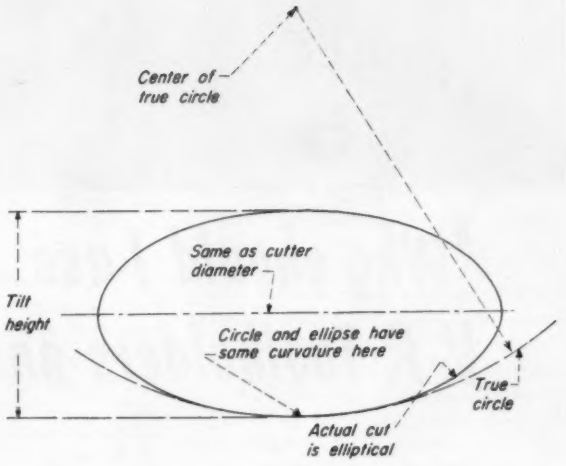
When a blueprint calls for milling a larger radius than possessed by any available cutter, the solution is to tilt the cutter. It's true that an ellipse, rather than a circular element, is generated. However, the error may not be important in many cases, and if it is the discrepancy can be corrected by working to a templet.

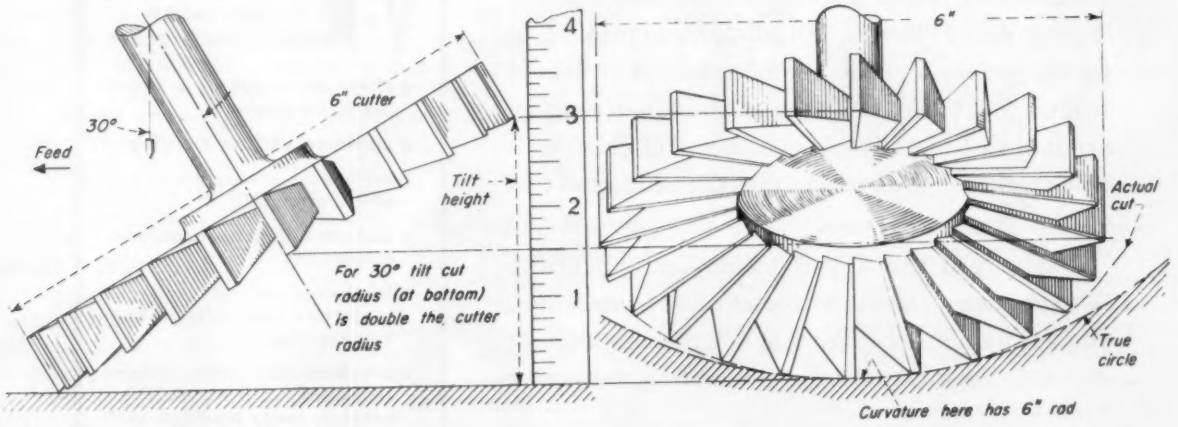
The tilt height of the cutter equals the cutter dia times the cutter dia divided by the dia of the required curvature.

Example: to approximate an arc of a 12-in. circle, using a 6-in. cutter.

Solution: tilt height = 6 x 6/12 = 3 in.

The accompanying table of ratios is based on the law of sines and will give the tilt angle when the ratio between cutter dia and curvature dia is known. In the above example, the ratio is 3/6 = 0.50. Tilt angle is then 30°, which checks with the example.





RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE	RATIO	ANGLE
0.05	2.9	0.21	12.1	0.37	21.7	0.53	32.0	0.69	43.6	0.85	58.2
0.06	3.4	0.22	12.7	0.38	22.3	0.54	32.7	0.70	44.4	0.86	59.3
0.07	4.0	0.23	13.3	0.39	23.0	0.55	33.4	0.71	45 2	0.87	60.5
0.08	4.6	0.24	13.9	0.40	23.6	0.56	34.1	0.72	46.1	0.88	61.7
0.09	5.2	0.25	14.5	0.41	24.2	0.57	34 8	0.73	46.9	0.89	62.9
0.10	5.7	0.26	15.1	0.42	24.8	0.58	35.5	0.74	47.7	0.90	64.2
0.11	6.3	0.27	15.7	0.43	25.5	0.59	36.2	0.75	48.6	0.91	65.5
0.12	6.9	0.28	16.3	0.44	26.1	0.60	36.9	0.76	49.5	0.92	66.9
0.13	7.5	0.29	16.9	0.45	26.7	0.61	37.6	0.77	50.4	0.93	68.4
0.14	8.0	0.30	17.5	0.46	27.4	0.62	38.3	0.78	51.3	0.94	70.1
0 15	8 6	0.31	18.1	0 47	28.0	0.63	39.0	0.79	52.2	0.95	71.8
0.16	9.2	0.32	18.7	0.48	28.7	0.64	39.8	0.80	53.1	0.96	73.7
0.17	9.8	0.33	19.3	0.49	29.3	0.65	40.5	0.81	54.1	0.97	75.9
0.18	10.4	0.34	19.9	0.50	30.0	0.66	41.3	0.82	55.1	0.98	78.5
0.19	11.0	0.35	20.5	0.51	30.7	0.67	42.1	0.83	56.1	0.99	81.8
0.20	11.5	0.36	21.1	0.52	31.3	0.68	42.8	0.84	57.1	1.00	90.0

"Why should I use V-R Toolholders and 'Throw-Away' Blanks?"

"Glad you asked me that question. There are many reasons why you should buy V-R Toolholders and 'Throw-Away' blanks, but all are summed up in saving you money. You are using an AR-16 brazed tool on that turret lathe job in your shop with an original cost of $2.84, plus your cost of grinding a chipbreaker in the carbide, plus the additional cost of each re-grind.

"When you use a V-R toolholder and utility 'Throw-Away' inserts at a cost of 56¢ per insert, you get six cutting edges that you can use without any grinding, completely eliminating expensive grinding costs.

"Try a V-R toolholder and 'Throw-Away' blanks and you will be amazed at the savings that are possible."

V-R TOOLHOLDERS WITH CAST ALLOY CHIPBREAKER PLATE

- eliminate chipbreaker grinding in the insert
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- are always on-center with any length of blank
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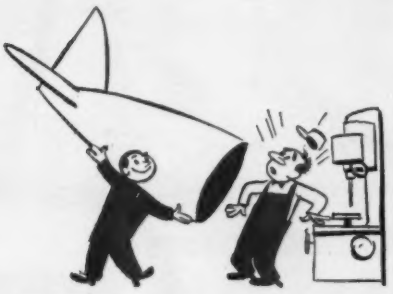
Talking Shop . . .



Making It Tougher

AIRCRAFT DESIGNERS continue with their policy of setting impossible problems for the shop. Good current examples are provided by the design of such elements as flat tracks and door guides with extremely close machining tolerances. Then, when all tolerances have been attained, usually at extensive cost, the finished part or assembly is hung on a sheet-metal structure and the tolerances go for nothing.

Sooner or later, aircraft designers and engineering departments must come to the realization that assembly tolerances must be as close as machining tolerances if the value of those close tolerances is to be retained. It will be necessary to abandon jig assembly of such parts and go either to integral structure or assembly *before* machining. The latter presents so many problems in terms of providing portable machine tools or special machine tools into which a fuselage section can be put that it should appeal to designers.

Wonder Metal?

TITANIUM, alternately praised and damned as a wonder metal is beginning to show some potential for civilian applications. One of the first is in racing sailboats where titanium fittings are far superior to anything else. Titanium, in sea water for example, would lose one-thousandth inch of surface in 1,250 years. This indicates applications in many industries where corrosion is a problem, including chemical and food processing. Titanium weighs 44% less than stainless and has about the same strength. It is currently several times as expensive as stainless, but this differential will of course be reduced as production increases. The sailboat boys are now crying for titanium wire and cable for rigging, figuring that the saving in rigging weight would be well worth the added cost.

Aluminum Beer Cans

A DENVER COMPANY, Aluminum International, Inc, is the second to announce work on aluminum cans for beer and other food products. The beer industry has a growing public-relations problem because of the tinplate cans littering highways, picnic grounds and camping grounds. Aluminum cans have the advantage that they are redeemable for full scrap value. Cost is currently prohibitive compared to tinplate, but there are possibilities of converting aluminum from ingot to can with many fewer steps than at present. A 7-oz can is redeemable as scrap for about a penny. It cannot be refilled, but can be melted down and refabricated.

Golly, What a Galleon!

FULL-RIGGED, four-masted galleon, 4 ft long and weighing 200 lb, has been constructed entirely from pewter by a father and son in Stockholm, Sweden. It took five years of their leisure time and represents every known art and method of working, casting, fashioning, and finishing pewter. It is on exhibition at the Tin Institute exhibition in London and will be brought to the US early in 1956 for exhibition in 10 principal cities, together with all the other examples of the pewterer's art, ancient and modern. Weight is 250 lb, value (insured) about £5000.

What UAW Missed

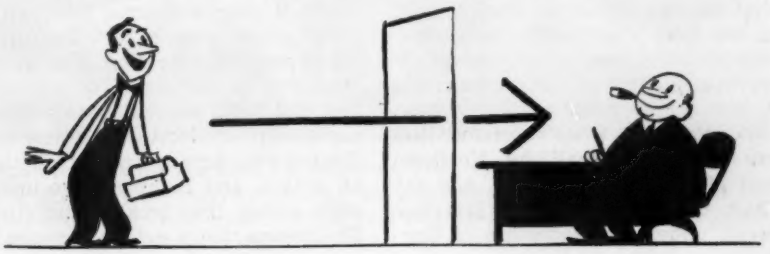
WHEN UAW REFUSED the offer of General Motors' common stock as opposed to the Guaranteed Annual Wage, it cost its members a considerable amount of money. The offer was made on a partial-payment basis. Since June 1, the value of the common stock has risen about $30 a share. The plan offered to the union permitted investment of as much as 10% of income in stock and US bonds. The average worker earning about $4500 a year thus could have acquired $450 worth of General Motors stock, of which one-half would have been free. This, on June 1, would have permitted purchase of 4.7 shares of stock, currently worth $600. In other words, the worker would have had a paper profit of $375 in less than one month, more than three times what General Motors has deposited this year into the trust fund at the rate of 5 cents a manhour worked. Such comparisons are of course always dangerous, but that is the way it works out in this particular case.

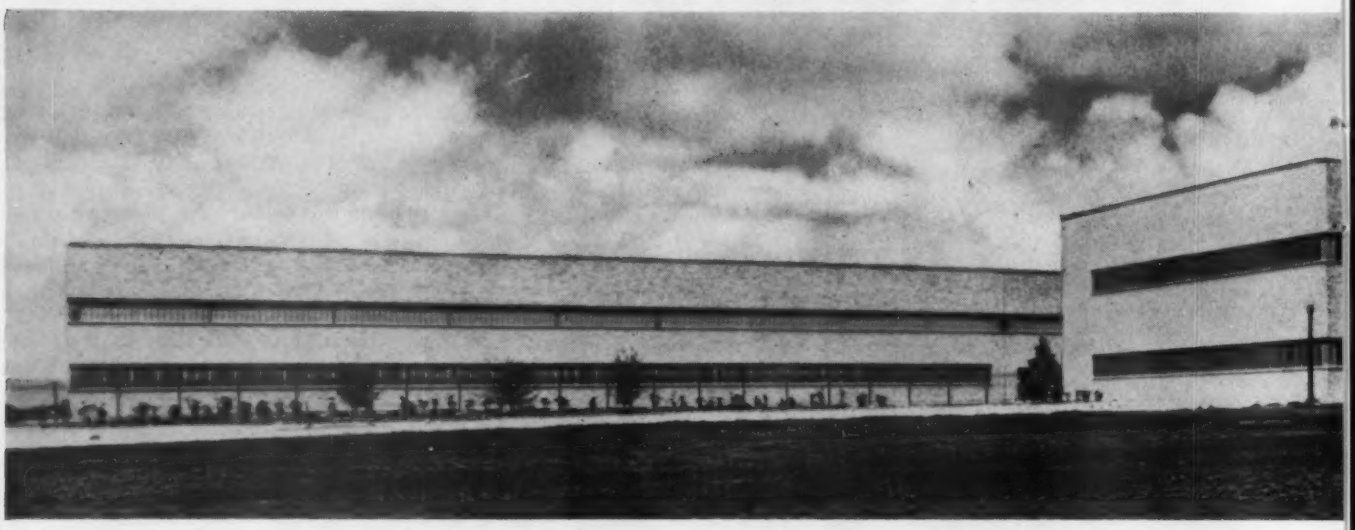
Wonder Battery

ELGIN NATIONAL Watch Co has developed a button-size battery which does not leak, swell or gas. It is claimed to have 25% more capacity than any other comparable sealed battery, and to deliver fairly constant output for a couple of years. The big secret is indium as an anode. This is a soft, silvery metal which has so little tendency toward leakage and gassing that separators and cases may be much thinner. A cell the shape of half a dime, and three times as thick, will deliver 1.15 volts and power a wrist watch. Similar cells might be used in many kinds of small instruments including portable meters.

Don't Go West

ANSEL R CLEARY, assistant director, Bureau of Apprenticeship, U S Dept of Labor, said recently that opportunities for advancement to management positions are greater for machinist apprentices who remain with the company that trains them. A recent study in Wisconsin of 315 apprentices who became journeymen in 1940-41 shows 268 remained in the trade. Of these, 115 became management; of the 15% who left Metalworking, the average worked six years as machinists before leaving. Men who shifted to other shops got more all-round machinist work to do but continued as machinists, while those who stayed with their original employer moved up.





What's Going on Down

Well, take North Carolina as an example. In the Tarheel State, King Cotton and King Tobacco had better look to their laurels—there's a husky, fast-growing young newcomer called Metalworking making a strong bid for No. 1 position in that state's economy. The governor of North Carolina recently gave AM Associate Editor Jim Linsley a personal invitation to "Come down and take a look around." Jim did—and here's what he saw

RALEIGH, N C—There's a new look in the South these days. Dixie's traditional economic standbys—cotton-textiles, tobacco, and wood-furniture—are having to make elbow room for a mushrooming Metalworking industry as major firms open new plants and create not only employment opportunities but a whole new concept of labor relations.

Take North Carolina, for instance, that traditional stronghold of the wood-cotton-tobacco triumvirate is fast diversifying its industrial picture. Gradual at first, the change is proceeding at a fast-increasing tempo. Last year alone saw more than 130 new industries springing up in the state. And particularly noteworthy is the number of new metalworking plants that bid fair to create a new major metalworking center.

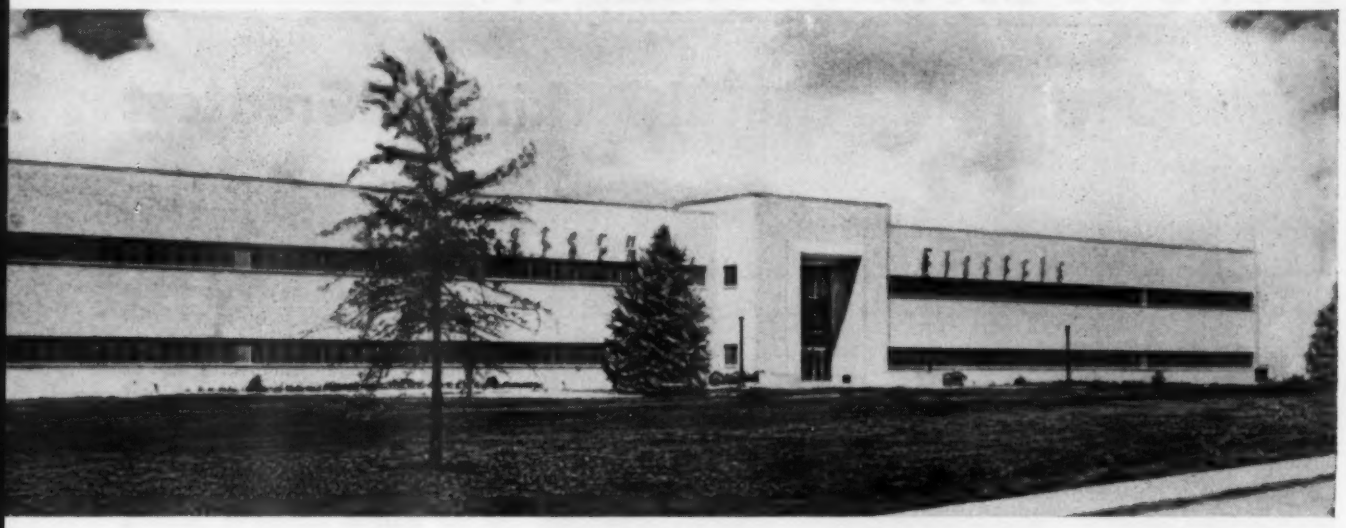
Most of the State's communities are relatively small by Northern and Midwestern standards, and the Dept of Conservation & Development, under the leadership of Governor Luther H Hodges and Director Ben E Douglas, has worked out a careful plan for statewide dispersal of the new industries to insure optimum utilization of available labor supplies and avoid the creation of over-industrialized areas. No pressure, of course, is applied to compel a manufacturer to select a particular area, but rather, the Department will point out the specific advantages of various locations.

The task of selecting a new plant location is made easier by the tax program. North Carolina is no Utopia—like any other state, it has its tax program and its tax problems—and it does not offer any "give-away" plans to entice new industries into a particular location. Each plant must pay its fair share of the burden. But taxes are moderate as compared to many Northern states, and the tax structure is unusual in that all schools and highways are under state, rather than local, jurisdiction. This means that a sudden increase in population caused by the construction of a new factory does not result in a sudden jump in local tax rates because of the increased demand for new schools and other facilities. The load is spread evenly over the state.

This new industrial shift has created a unique opportunity for state-wide planning. With the state starting virtually from scratch, in the metalworking field at least, it is possible to carry out an organized scheme of industry dispersal, and it is undoubtedly better for the people as a whole to have a hundred plants scattered among 30 or 40 communities than to have them concentrated in one or two areas. From the national security standpoint, too, this decentralization is highly desirable, and it is worth noting that not a single critical target area is located within the state boundaries.

How about Labor?

It is perhaps logical to inquire why the metalworking industry should turn to so predominantly an agricultural and textile area in its search for new locations. Here, there is no generations-old tradition of craftsmanship, no permanent pool of experienced machinists, no great metropolitan area as an immediate outlet. Yet the answer is not far to seek. It lies in the unquestionably higher productivity per employee. And the underlying cause for this is in the deep-rooted religious convictions of the greater part of the state's citizens. Unaffected by the bitter labor-management feuds of



Western Electric's giant new electronics plant . . .
Typical of the new plants now being erected in the South is the recently completed Western Electric factory at Winston Salem. Front structure is the office building; behind is the 760 x 360-ft manufacturing building

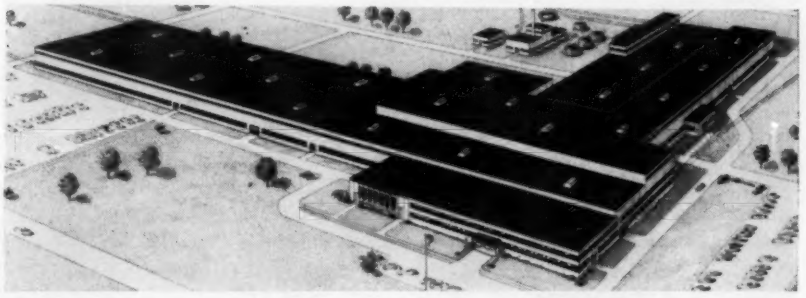
South?

the past hundred years, the average worker feels himself bound in conscience to deliver a fair day's work for a fair day's pay. The sentiment is not openly expressed with pious exclamations—it simply exists and is taken for granted. Nor does it appear likely that changing economic conditions will materially affect it.

And economic conditions are changing. The barefoot mountaineer of the Great Smokies is fast fading into a legend; the tumbledown log shanty is being replaced by neat, white, frame houses; and there is a modern automobile parked by each one. There are more goods to be bought, and more money available with which to buy them. Wages in the metalworking industries are somewhat higher than normal for the area, although perhaps slightly lower than in similar plants in the North. The difference, however, is not particularly significant and is not a governing factor.

What is particularly important is the mental attitude of the people toward the new field of employment. He is an independent fellow, this North Carolinian, and he does not take kindly to regimentation or to being pushed around. He is willing to work, and willing to learn, but he will stand for no dictation from either management or union leaders. The new Westinghouse plant at Raleigh offers an excellent example of this. It is unique in that it is the Corporation's only non-union plant, and this by employee vote.

(Continued on page 156)



GE's $20-million plant at Hickory, N C . . .
Twenty-million-dollar plant now under construction by General Electric at Hickory, N C, for production of distribution transformers to meet anticipated demand for electric power in the South

Retraining textile workers for Metalworking . . .
It's a far cry from cigarette-making machines or the clattering looms of the cotton mills, yet these girls perform intricate operations on electronic equipment after only a brief training period at Western Electric plant

Setting Up Metalworking's "Greatest

With the biggest industrial show in history, the Machine Tool Show, only a month away, how are things going out at Chicago's Amphitheater? We sent News Editor Bob Sheets out to take a look. He went, he saw, and he was conquered by the ease with which crews out there are performing miracles of machinery moving and installation

CHICAGO — It's a month before the show and it's hot here in Chicago: the thermometer on the way from the airport registered 107 in the sun. You get the okay from the guard at the entrance and walk into the Arena of the International Amphitheater.

Even at this stage, the Machine Tool Show is impressive. Maybe 40 machine tools and presses are already in place in this Hall of Giants. They range from screw and bar machines up to huge planer-millers, boring machines and presses.

Down at one end are a few ghostly looking shapes, machines heavily shrouded, whether for purposes of dust protection or last-minute surprise value no one seems to want to say. But there's no peeking or the Pinkerton man will be over with murder in his eye.

Things get done — fast

It's hot outside and it's hot inside, and the dozens of machinery riggers and movers seem to be working at a casual pace. That casual pace is a snare and a delusion as you soon find out.

Watch for a while. A goodish-sized press is trucked in. One of the floor managers consults his plan, looks at the adhesive-taped arrows and X's that mark booth and machine locations, points out the spot where he wants the press. A mobile crane moves in, with it maybe a half dozen or so riggers. If you want to watch this machinery rigging and moving operation, don't wander over to the refreshment booth for a coke. If you do, you'll find it's all over when you get back — it's handled just that fast. A job that would give the average plant superintendent or chief engineer a week of installation headaches has been done in a matter of minutes.

You'll find this air of quiet efficiency all up and down the line here at the Amphitheater — this way of getting even the most monumental jobs done without fuss or feathers, and in a hurry. The reason is experience, from top management down to laborers.

"Like a well-oiled watch"

To find out how and why this toughest of all industrial show set-up jobs ticks like a well-oiled watch, you climb a short flight of stairs to the balcony. Inside a door marked "National Machine Tool Builders Association — Tell Berna, General Manager," you find Mrs Florence Bihl. She works for the Chicago Convention Bureau, will have charge of the 70 to 100 girls who'll handle registration.

"Mr Berna's gone back to Cleveland, but he'll be here Monday," she says. This is standard operating procedure for Mr Berna these days. Right now, he's running back and forth to Cleveland with the regularity of a commuter catching the 5:15. Later, as show preparations start to snowball, he'll practically live right here in the Amphitheater — eating, breathing and sleeping Machine Tool Show.

Paging Dick Tracy

Go across the hall to Clapp & Poliak, the exhibit managers, she says. You do. For a rarity, both Mr Clapp and Mr Poliak are in. One or the other is always on tap to act as trouble shooter — usually it's Truman L Clapp, who's come out of retirement for the Machine Tool Show because, like the proverbial Irishman, he just can't resist a good fight. At the moment, he's interested in what he calls the "Dick Tracy two-way wrist radio" setup they're installing between his office and the floor managers. It'll save a lot of leg work when the going gets rough. When Clapp or Poliak want someone on the floor they buzz one of their four managers, who carry lapel receivers. When he hears the buzz, the floor manager plugs into one of a dozen wall outlets with a belt microphone and talks to the boss.

Saul Poliak sits across the room in front of two phones that seldom stop ringing. You wait while he talks to the man in charge of painting signs for the show. "Come in," he says, "I've been expecting you. I've only got two hours before I catch a plane back to New York. Got your notebook ready? I'm going to take you around to all the key men putting on the show. Don't take notes now. Just shake hands, write down the man's name and come back and talk to him later. Okay? Let's go."

Gas-buggy safari

Saul Poliak is a man in a hurry. You tear downstairs after him, fall into the private gas-buggy that gets him around the Amphitheater in no time flat. He's got an eye like an Indianapolis driver. You scoot between towering machine tools, around aisle corners, and wind up at a door in the new annex marked "United Exposition Service."

"This is one of the Katz boys — Harry," he says. "He's the guy who rents exhibit furniture and draperies, moves bar stock in to the exhibits and finished products out, besides doing practically everything no one else has time to do around here. Okay? Got his name? Now let's go see Bob Rosenberger. He's the man who's responsible for machinery moving and erecting. He's fabulous."

You meet Rosenberger, you meet the Amphitheater's electrical boss, you meet Clapp & Poliak's floor managers, you meet a lot of key people in a hurry. Tomorrow, you'll come back and talk to them.

You come back around nine the next morning, early for a visiting editor who's motto is "let the guy open his mail first." But in this case there's no mail for your interviewees to open, and they've been on the job for at least an hour when you get there.

Show"

"Begin at the beginning," you say to yourself, "how about all these fancy electrical bus ducts running across the exhibits?" The man to see for that is Bob Benson of Produce Terminal Corp, part of the Union Stock Yard & Transit Co setup. You met him yesterday. He's got a tiny office he shares with fellow boss electrician Frank Schimandl and a secretary. "Sit down," he says, moving a pile of papers and diagrams off the only free chair, "What do you want to know?"

"Biggest we've ever handled"

"Everything," you say. He tells you that this is the biggest show job he's ever handled. That by the time the show opens its doors he'll have 100 to 125 electricians at work in the Amphitheater and the new annex. The new annex, he says, is built from top to bottom to accommodate the Machine Tool Show, and it's rigged electrically with that in mind.

For instance, three transformer vaults have been built for the addition. Each has a capacity of 1500 kva, and each supplies 14 runs of 250-ft-long, 600-amp, 3-phase, 440-volt bus ducts that supply the exhibits. Altogether, the new addition has 8000 connected-hp of electricity. The main building of the Amphitheater has the same. Eight runs of bus ducts have been added to the main building especially for the show. Both it and the addition have 4500 kva available. Combined connected horsepower of the two buildings is 16,000 — the most power ever installed for any Amphitheater show. The tailored-to-the-Machine-Tool-Show new addition has 30-35 foot candle lighting throughout. Lighting in the main building wasn't that good, except for the 60-ft-candle Main Arena, so temporary lighting has been installed in the main building's north and south halls to up lighting to 30 ft candles.

Benson's men do "everything electrical in the building," plus wiring the exhibits. The exhibitor sends in his electrical requirements well in advance of the show so that drop feeders from the bus ducts can be installed. The exhibitor can have one of his own men supervise control

"A LOT OF MACHINES ARE SHIPPED IN LYING ON THEIR SIDES" and getting this huge Clearing press set up in the main arena was some job. The photo was taken by one of Pennover Merchants Transfer Co's machinery movers, Jack Weld, an amateur lensman — and a good one, too, as this photo proves

"SPUR TRACK RUNS RIGHT INTO ANNEX," and from it more than 5-million lb of machine tools have been unloaded since preparations started at the International Amphitheater back around the first week in June

MACHINE TOOL SHOW (continued)

wiring and connections to drop feeders, but exhibitors' people can't touch the actual electrical work.

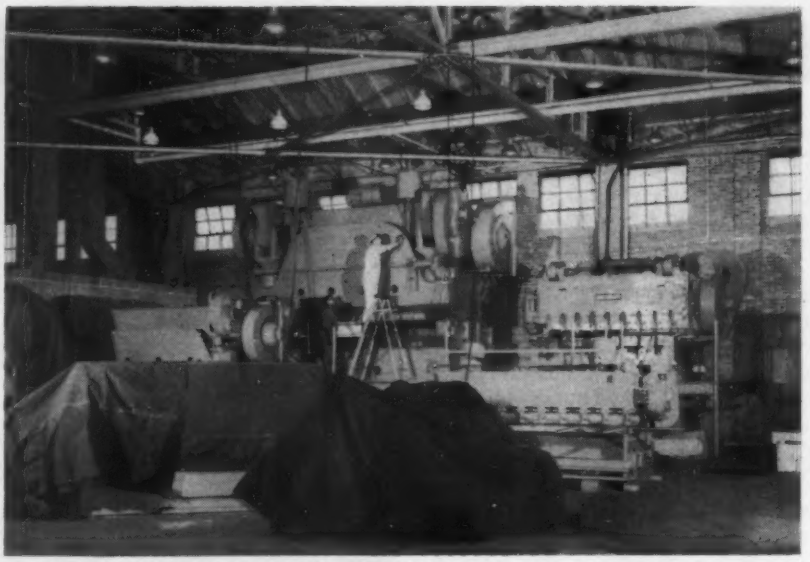
You leave Benson's office, learn your next stop, Pennoyer Merchants Transfer Co, is way over in the new annex. You begin to wish you had Saul Poliak's gas buggy.

Those fabulous movers

Pennoyer's office is alongside the spur track that runs into the annex. It's a big office, but it's stacked to the ceiling with ropes, pulleys and crowbars. Looks more like a warehouse. At one end several desks are butted together to form one long one. In the middle, surrounded by advice-seeking crew chiefs, clerks, and flies from the stock yard, sits the master mind of the show's machinery movers, Bob Rosenberger. There's maybe a dozen men running in and out and asking him questions at once. One wants to know where in hell is that shipment from New England — and if it doesn't get here, can he move another flat car in. No, says Rosenberger, exhibits this big have to go in in order and out in order, otherwise how're you going to squeeze a 50-ton press in a tight space between a planer-miller and another press? Another wants to know can he take on another crew, and so on. Rosenberger answers question after question calmly. You get the idea that the reason things run so smoothly outside is that the answers are all here and they're right, before the floor work starts. You wait for a chance to talk to Rosenberger, it doesn't come, he's too busy.

You buttonhole one of his assistants. He tells you Rosenberger has been in the business 40 years, that he's the old master of the machinery moving business. "We handled the '47 show here, too," he says, "Then we had 105 movers, 30 millwrights, and 10 supervisors and assistants at work when we reached the peak just before the show opened. By the time this one opens, we expect to have twice that many men at work."

Pennoyer's job starts at the unloading platforms — either trucks or railroad cars. The machines are moved to the booths. Then a new crew moves in, uncrates and unskids the machines, and aligns and levels them. "A lot of machines are shipped in lying on their sides, we lift them upright with a mobile crane. Biggest job we've handled that way so far is that big 89-ton Danly press out there. The crown alone weighed 47 tons. It was a rough job."



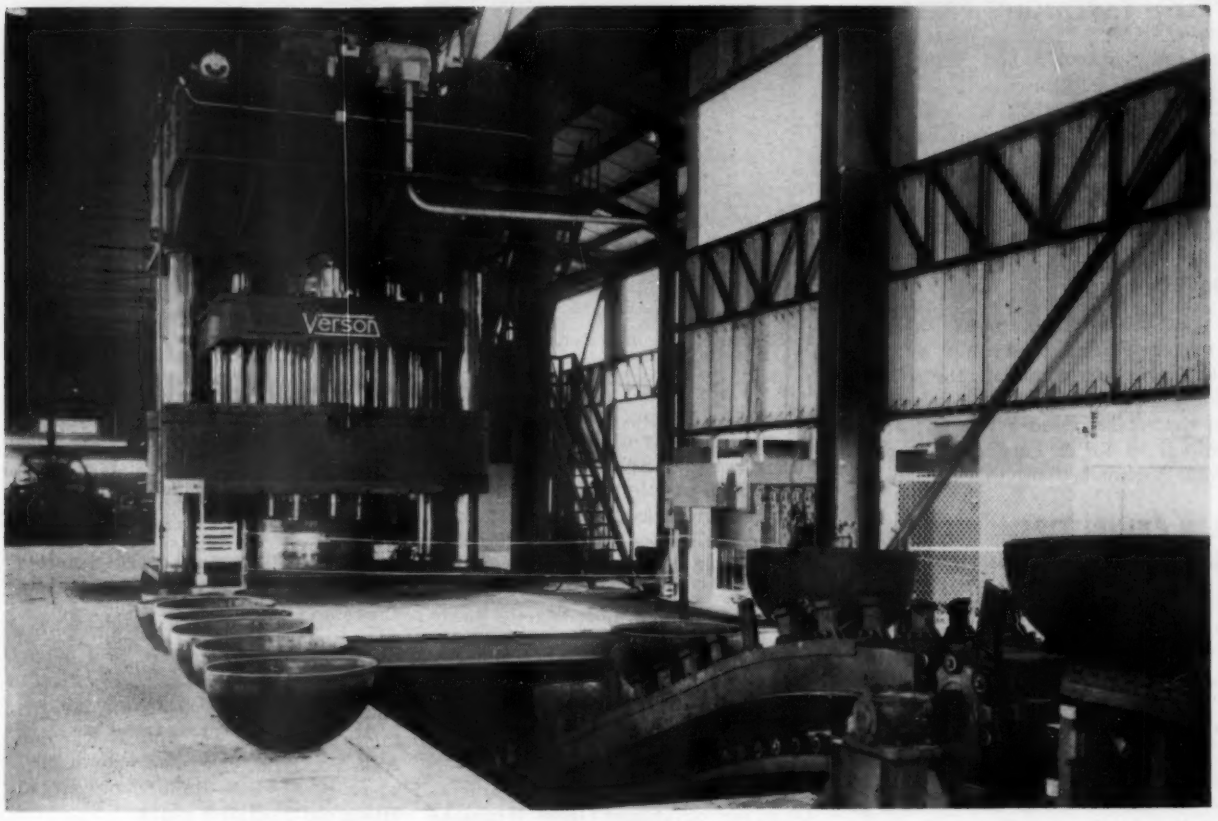
"MACHINES HEAVILY SHROUDED," for secrecy or for protection against dust and dirt, stand in front of a huge Cincinnati Shaper Co 1½-in.-thick capacity shear press and press brake in the new International Amphitheater Annex. Workman is putting finishing touches to the press brake

Pennoyer's work ends with installation. The firm doesn't touch the electrical hookup. But work will start in reverse when the show is over. Everything has to come out just the opposite from the way it went in "or there'd be an awful snafu."

Next, over to Poirot Exhibitors Service to see what's going on there. These are the people who handle plumbing, carpentry work and painting, plus a few dozen other assignments nobody else can handle because of inter-union jurisdiction. E C Fisher, Poirot VP who handles the show, isn't in, but his secretary gets him on the phone. He's pretty swamped at the moment. His firm has two of the biggest jobs in its history running at the same time, the Machine Tool Show and the GM Powerama at Soldier Field. Poirot will have close to 300 workers at the Machine Tool Show, and 800 at the Powerama at the same time — a big labor force that sprawls over into about eight unions, a fact that gives Poirot union jurisdictional scope to do jobs more limited outfits can't do.

Poirot's staff is starting to snowball as the show's opening day gets nearer. By peak time, the firm will have some 200 carpenters building flooring, aprons, platforms and backgrounds; 20 painters at work on machines and exhibits, 6 sheet metal men, 20-25 ironworkers, and maybe 30 fitters (plumbers) to rig anything that needs piping. On top of all this, the company has men digging pits in the concrete floors to accommodate some machines (they'll repair the holes when the show's over, too), others erecting tramrails, and crews that erect and dismantle displays. "We like to work on a show of this kind," Fisher says, "the men like it. They feel they're making a real contribution to industry. And they work with men of their own kind — exhibitors and their crews who speak the language. These machine tool people know their stuff. I don't mind telling you they're the nicest people we've ever worked with."

That about sums up the way people feel around the Amphitheater. With the biggest, toughest show job in industrial history coming up, things are getting done around here — quickly, quietly and with a minimum of fuss. Because each man involved in this tremendous operation is an expert in his own right, every operation dovetails neatly, and it's no lie around here that "the improbable will be done immediately. The impossible will take a little longer."



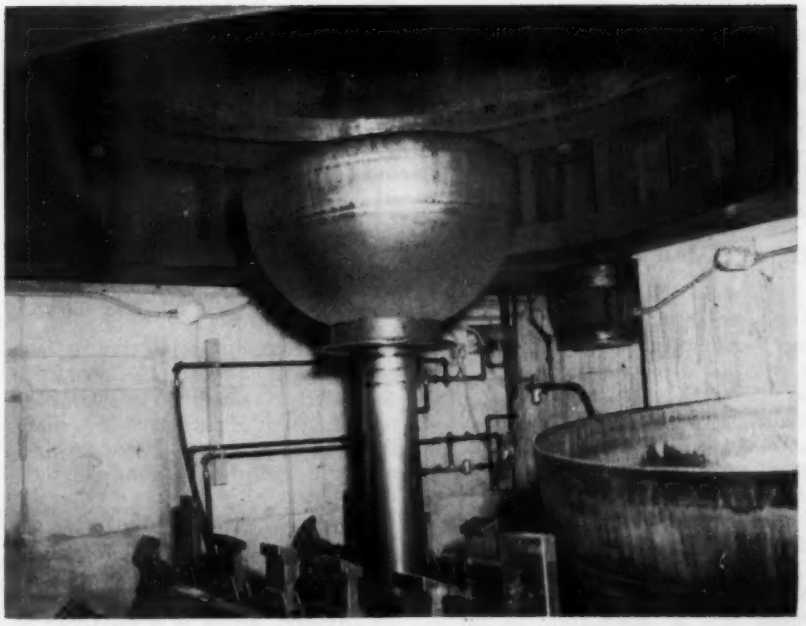
Biggest "Push-Through" Press Goes to Work

WILMINGTON, DEL—Believed to be the biggest and fastest press of the "push-through" type, a Verson 3,000-tonner is producing dished heads in diameters from 37½ in. to 120 in. at Colorado Fuel & Iron Corp's Wickwire Spencer Division Plant at Claymont, just outside Wilmington.

Unique "Escalator"

Unique feature of the three-story press is an "escalator" system located under the ground floor that, as the punch comes down and a stripping ring releases the formed head, sends a hydraulic elevator shaft up to receive the head, then lowers it to a link-chain conveyor with sloping dogs. The conveyor carries the formed head up a 17° incline to floor level, slides it onto a 60-ft gravity conveyor that takes it to the head-trimming machines.

The press, using dies of various ferrous metals, will currently press dished heads up to 120-in. dia from cold ¼-in. plate, and will press con-



ELEVATOR SHAFT in chamber under ground floor of the press lowers a dished head onto conveyor that takes it upstairs to trimming department

"PUSH-THROUGH" PRESS
(continued)

siderably heavier hot plate when additional equipment is installed. The press can work with virtually any metal, including stainless. Current production is on 40½-in. ID hemispheric propane heads made from ¼-in. ASTM A-295 Grade C flange carbon steel plate.

Double Action

The press gets its total 3000 tons pressure from a double action—2000 tons pressure on the punch-holder, and 1000 tons on the blank holder. It required seven flatcars to ship it to CF & I's Claymore plant from Verson's plant in Chicago.

250 EXHIBITORS SLATED FOR PE SHOW

CHICAGO—Some 250 firms will display automation and production equipment at the Production Engineering Show, to be held at Navy Pier here concurrently with the Machine Tool Show, September 6-16. This will make it the largest initial show ever staged for any new series of annual industrial expositions, according to Clapp & Poliak, Inc, who will produce the show in conjunction with the Machine Tool Show, and with full sanction of the National Machine Tool Builders' Association. Buses will run between the two shows, which between them are expected to attract anywhere from 100,000 visitors upwards.

A major feature of the Production Engineering Show will be an unprecedented joint presentation by *American Machinist* and other McGraw-Hill magazines of industrial research results from eight engineering colleges.

Eight Major Classifications

The show's exhibits will fall into eight major classifications: monitoring equipment, governing equipment, special production equipment, equipment components, materials handling, machine tool accessories and inspection and gaging equipment of all kinds.

Hours of the Production Engineering Show and the Machine Tool Show have been coordinated to allow visitors to make maximum use of their time. The Machine Tool Show will be open from 10 am to 5:30 pm, the Production Engineering Show from 1 to 10 pm.

Companies in the News . . .

Simonds Saw & Steel Co, Fitchburg, Mass, has made arrangements to operate **Heller Brothers Co,** Newcomerstown, Ohio, makers of files and rasps, as a subsidiary, **Heller Tool Co.** Heller files will be added to Simonds' line of "Red Tang" files.

GM's Fisher Body Division plans to build a stamping plant containing 1.7-million sq ft of floor space on a 164-acre site near Marion, Ohio. Some 3000 people will ultimately be engaged in making body parts and subassemblies for shipment to other Fisher plants.

Rhodes Lewis Co, Los Angeles pump and valve manufacturing subsidiary of **McCulloch Motor Co,** has been purchased by **Fairchild Engine & Airplane Co,** will be operated by Fairchild's **Stratos Division.**

City Auto Stamping Co, Toledo, Ohio, has purchased **Globe-Wernicke Co,** Cincinnati manufacturers of metal office equipment, for $6 million, as a diversification move.

Spincraft Inc, Milwaukee, has bought out **Falcon Tool & Die Co,** also of Milwaukee, will make it its Falcon Division.

Worthington Corp has purchased a 15-acre site in East Orange and Newark, NJ, from the Elliott Co. The site contains a dozen or so buildings with combined floor space of 330,000 sq ft, formerly occupied by Crocker-Wheeler Electric Co. Worthington will install part of its air conditioning and pump manufacturing operations.

Kaiser Aluminum & Chemical Corp reports installation of the two 8000-ton Air Force heavy extrusion presses at its Halethorpe, Md, plant is nearly completed, expects to get one into operation around September 1.

Hupp Corp and **Perfection Industries Inc** are merging. Hupp will become the parent company and Perfection its Division. Hupp is a producer of military components and of components for other manufacturers. Perfection is primarily a producer of consumer items. Hupp has plants in Chicago and Detroit, is terminating operations at its Globe Stamping Division in Cleveland. Perfection has two plants in Cleveland, and one is being built in Waynesboro, Ga.

Northrop Aircraft and its subsidiary, **Radioplane Co,** will build a 25,000-sq-ft guided missile component pilot plant in El Paso, Texas, will ultimately build a much larger plant in that area.

Steel Founders' Society of America has moved to 606 Terminal Tower, Cleveland 13.

R Hoe & Co Inc, New York, nation's oldest maker of saws and printing equipment, has opened a saw manufacturing plant at 2700 E Tacoma Ave, Portland, Ore. The new 30,000-sq-ft plant will double output of Hoe's old Portland plant.

Wheelabrator Corp is the new name of **American Wheelabrator & Equipment Corp,** Mishawaka, Ind. No other changes are involved.

Hallden Machine Co, Thomaston, Conn, has increased its automatic shear manufacturing space 60% with a new plant addition.

American Motors Corp is reported to be in the black for the first time since the Nash-Hudson merger on May 1, 1954. In the quarter ending June 30, AMC earned a profit of $1,592,307.

Pressed Metals of America Inc will become the fourth Michigan firm acquired by **Frederick W Richmond,** New York financier, and his associates, if stockholders approve the sale on terms of $7 million cash, plus assumption of some Pressed Metal liabilities. A subsidiary, **Acorn Products,** is included in the sale.

Chrysler Corp is expected to buy the plant, equipment and inventories of **Universal Products Co Inc,** Dearborn, Mich, maker of automotive drive shafts and components, and universal joints.

Abrasive Machine Tool Co, East Providence, RI, appointments: **Walter P R Sceeles** (left), sales manager, to assistant to the president; Mr Sceeles, with the company for 32 years, will serve as senior administrative and sales advisor; and **Joseph T Vinbury,** formerly advertising manager of the New Britain Machine Co, to general sales manager. Mr Vinbury has been a member of the advertising and market research committee of the National Machine Tool Builders' Association for the past six years, chairman for the last three

Robert E Glauque, formerly quality coordinator with the Hamilton Standard Div, United Aircraft, has been appointed works manager and chief engineer of The E Horton & Son Co, Windsor Locks, Conn

Names in the News . . .

John C Coonley, formerly general manager of ACF Industries' Valve Div, has been elected president of Hydraulic Press Manufacturing Co, Mt Gilead, Ohio.

Fellows Gear Shaper Co, Springfield, Vt, appoints: **George H Sanborn,** general sales manager; **Carl S Rice,** sales manager, Cutter Div; and **J F Hronek,** sales manager, Plastics Div.

Jack F Anschuetz, formerly sales manager for Clearing Machine Corp's Hamilton Div, has been named sales manager for Baldwin-Lima-Hamilton Corp's Hamilton presses.

F J Geiger, manager of sales and engineering, electrical section, of Allis-Chalmers Norwood (Ohio) Works, has been named general manager there. He succeeds **P F Bauer,** appointed general manager of the company's industrial equipment division.

Ralph J Eschborn, assistant chief engineer of Jack & Heintz, Cleveland, has been named chief engineer.

Frederick J Lanz and **John P Finn,** sales engineers of Harrington Machinery, Inc, West Hartford, Conn, have been elected vice presidents of the company.

Curtis B Hoffman, formerly assistant to the president of Foote Bros Gear & Machine Corp, Chicago, has been appointed vice president, sales, of Brush Electronics Co, Cleveland.

Goddard & Goddard Co, Detroit metal cutting tool manufacturer, has realigned its management personnel. Appointments: **H C Henderson,** executive vice president and treasurer; **L H Goddard,** vice president, marketing; **S H Grattan,** vice president, engineering; **W H Fritz,** vice president, manufacturing; **Margaret E Adams,** secretary and controller; **J Tocco,** industrial engineering; **W A Sommer,** director, industrial relations.

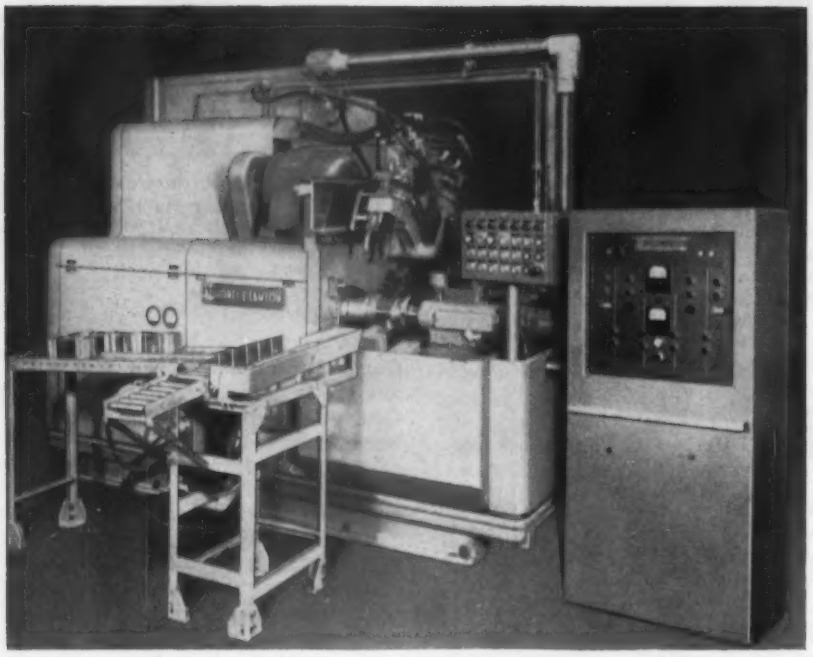
Harry R Cole, assistant works manager of American Car & Foundry's St Louis Car plant, has been promoted to works manager.

T S Bonnema, vice president and factory manager of Oster Manufacturing Co, Cleveland manufacturer of pipe and bolt threading machinery, has been elected vice president and general manager

George Cameron, formerly co-owner of Cameron & White Co, Detroit engineering firm, has been appointed director of engineering for Colonial Broach & Machine Co

Carl J Meister has been elected executive vice president of Borg-Warner Corp's Atkins Saw Div; **Howard O Wiesen,** vice president, administration; and **Robert M Zimmerman,** vice president, manufacture

New Shop Equipment



Self-Resetting Fay Automatic Indexes Round Tool in 3° Steps

Feedback information from the still-rotating part is translated into impulses which correct tool location in this self-resetting Fay automatic lathe. As successive parts approach high or low tolerance limits, the tool is moved in or out to make up for the difference between part size and mean dimension desired.

The turning tool is a carbide cylinder mounted on a post in the carriage, and is self-adjustable in either of two ways:

The toolpost, really a 2-part toolblock, the lower similar to a compound, the upper hinged. Automatic feed in or out is obtained by tilting the compound angularly with relation to the saddle. Lifting is done by an eccentric shaft working against a wear face. The eccentric has 10 steps of 0.0002 in., for a total adjustment of 0.002 in., and is driven by one of two single-direction ratchets under electronic control. One ratchet drives forward, the other back, and indexing is always positive.

After the eccentric has corrected size as far as it can (in its 10 steps), it returns to starting position, and the round tool is indexed 3°. This is possible because the normal toolholder is replaced by a block which holds a shaft and capscrew on which the tool is set. (The tool is straight-sided, so the angle of the toolshaft gives cutting angles.) For the 3° rotation, the toolshaft is indexed annularly through a work shaft and one-direction motor. New cutting edges are provided by rotating the bit for 103 positions. Then the capscrew is removed, the bit inverted, and the tool is ready for another 103 indexes, after which it is discarded.

After 103 indexes the block is interlocked so the cycle is shut down, indicating the need for a new tool. Estimates are that each tool is good for 6000 pieces (3000 on a side) on such work as motor rotors (silicon steel), and, because production is expected to be 1500 pieces per shift, each bit should last for 4 shifts.

GAGING

Gaging is done with a magnetic proximity gage with an air gap of 0.005 in. It rocks in for ½-sec dwell at the end of the cutting cycle. Because the piece is still moving, the gage measures *average* diameter, and doesn't confuse roundness and height. If desired, the gage-control indexing can be replaced with automatic cycle indexing, turning the tool after any given number of pieces. The number would be set on an automatic counter already incorporated on the door of the electronic compartment.

THE MACHINE ITSELF

The lathe is basically a Fay automatic lathe with automatic loading and unloading equipment, plus classifying conveyors, automatic gaging and tool resetting, and automatic chip handling and disposal.

Jones & Lamson Machine Co, Springfield, Vt

MORE DATA? Circle FYI 61, inside back cover

Multiple-Operation Toolholder For Throw-Away Carbide Inserts

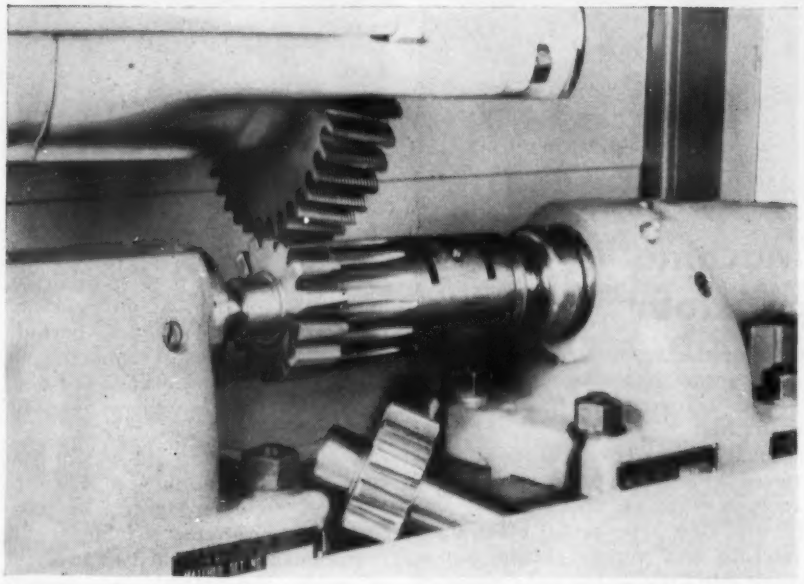
Universatool has been developed to perform lead angle facing or turning, in both directions; grooving, chamfering, both sides; and combination plunging-turning operations.

Square throw-away carbide insert provides four sides with the positive rake holder. Included in the holder design is the Viking fully adjustable chipbreaker, replaceable carbide anvil, positive insert location, and indexability within ± 0.002 in. Details in bulletin 552.

Viking Tool Co, Shelton, Conn

MORE DATA? Circle FYI 62, inside back cover

Materials and Parts . . .



New Red Ring Process Developed For Shaving Conical Involute Gears

Process, which will first be applied to shaving teeth on steering gear segments in automotive power steering mechanisms, makes use of a special patented conical helical shaving cutter, and can be performed on standard Red Ring diagonal rotary gear shaving machines. It reportedly produces a gear that meets rigid engineering specifications for surface finish, size and accuracy of tooth taper.

Steering gear segment is mounted in an arbor assembly having steel dummy teeth which complete the tooth circumference. The piece is located in correct axial location in arbor and dummy assembly by clamping it against the face from which it was generated in the previous gear tooth roughing operation. Then the gear and arbor unit are mounted between centers in mesh with the cutter on a standard Red Ring machine set up to shave the gear by the diagonal method. Cutter and work gear centerlines are set at a slight crossed axis angle for the operation. Pushbutton control on the machine causes work gear assembly to feed across the cutter on a diagonal path at 90° to centerline of cutter. Work gear feeds back across the cutter, and gear and arbor unit is removed, thus completing the cycle.

Cycle time for the operation is said to be at least as fast as for any other gear of similar size and tooth specifications produced by the diagonal shaving process. About 0.004 in. of stock is removed. Typical sector shaved has five conical involute, tapered teeth that mesh with a 5-DP rack having a normal pressure angle of about 20°. Special shaving cutter used has a 9-in. OD, is about 1⅜ in. wide.

National Broach & Machine Co, 5600 St Jean Ave, Detroit 13, Mich

MORE DATA? Circle FYI 63, inside back cover

Toolbits are available with HSS tips welded to carbon-steel shanks maintaining a high R_c 65-68. Tools are surface-ground to plus 0.000 minus 0.004; sizes from 5/8 to 1-1/2 in. in squares, and 1/2 x 5/8 in. to 1 x 1-1/2 in. in flats.

Plew Tool Co, Columbia City, Ind

MORE DATA? Circle FYI 64, inside back cover

. . . including

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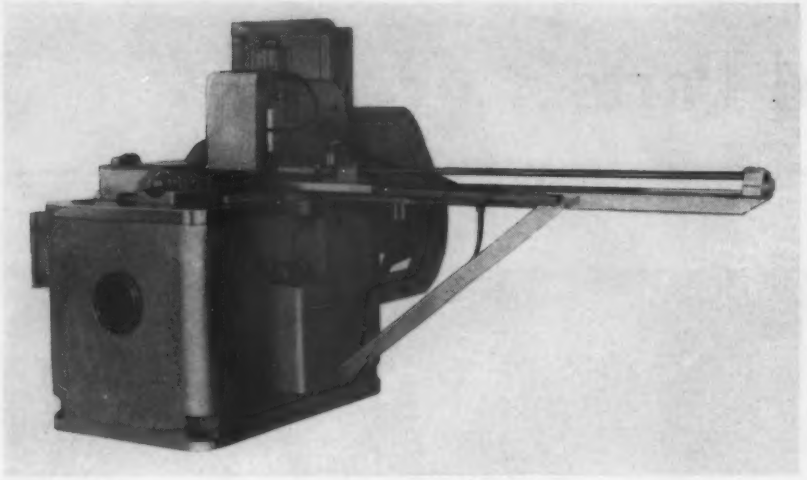


Grieder Tube Cutoff Machine Can Make 6000 Cuts per Hour

Utilizing the shear-type cut, the machine, said to be accurate within 0.003 of an inch, cuts off tubing of all sizes and shapes from ¼ to 4 in. OD. Model 2000 MAC cuts material ranging in diameter from ¼ to 2 in. with wall thicknesses up to 0.125; Model 4000 MAC, 2 to 4 in., up to 0.187. Former can make up to 6000 cuts per hr, depending upon length of cut; rate of feed is 600 fpm. Speed of the 4000 is less.

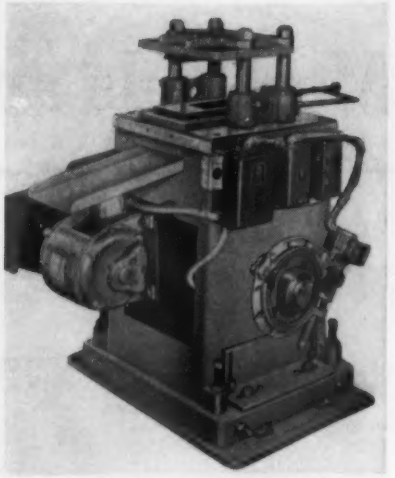
Feed is accomplished by a number of opposed rolls that feed tubing automatically through the machine to a positive stop located in alignment with the stock. Stock is held firmly in dies which act as a vise, and are of the same diameter as tubing to be cut. Tubing remains stationary during the cutting action; cut is accomplished by means of two blades actuated by the machine crankshaft.

Small horizontal cut is made first, removing only the top portion of the tube, leaving an opening into the bore of stock. Horizontal blade then retracts, and vertical blade comes down into the opening and completes cut without distortion and with minimum burr. Both cuts are accomplished in 1/3 of a second on a wall thickness up to 1/16 in.

Method can be used on steel, copper, brass, aluminum, stainless, and various other alloy tubing.

Grieder Industries, Inc, Bowling Green, Ohio

MORE DATA? Circle FYI 65, inside back cover



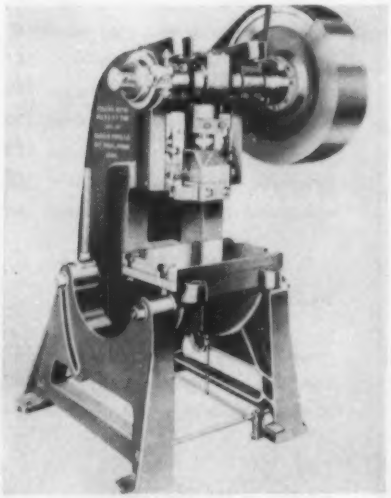
High-Speed Flying Cutoff Press

Model, designed to provide accurate, high-speed production on cutoff of roll-formed metal shapes, permits use of coil stock instead of cut lengths. Amount of scrap is reduced, and more uniform shapes can be produced.

Operating speeds are 240 or 300 rpm; capacities from 4 to 120 ton. Features include: flag trip or positive mechanical runout table to suit requirements; simplified adjustment of height and lateral requirement; mechanical clutch on 4-ton units, and air clutch with air brake on 8 to 120-ton units.

Dahlstrom Machine Works, Inc, 4225 W Belmont Ave, Chicago 41, Ill

MORE DATA? Circle FYI 67, inside back cover



New 37-ton Press Added to Press-Rite Line

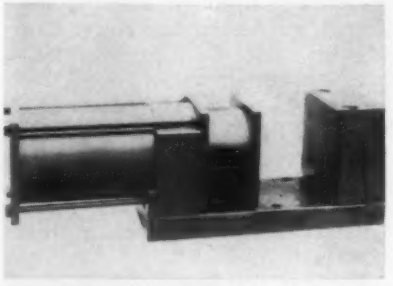
Rugged, specially designed high-strength alloy frame and heavy reinforcing ribs on Model 3½ increase die life. Ribs extend from the main bearings, around the gap, and down beyond the bolster. These are supplemented by webbed ribs on bed, base, or ram bearings, and above main crankshaft bearings, eliminating any possible die-wearing deflection even under maximum capacities.

Additional features include: positive single-stroke safety clutch; cam-actuated brake, full V ramways; and extra heavy ram slides. With the four-point mechanical clutch, standard speed is 120 spm.

Unit may also be equipped with variable speed drives, and with Airflex air-friction drum design clutch. In addition, electrically controlled brake for maximum operating speed can be furnished.

Sales Service Machine Tool Co, 2363 University Ave, St Paul 14, Minn

MORE DATA? Circle FYI 66, inside back cover



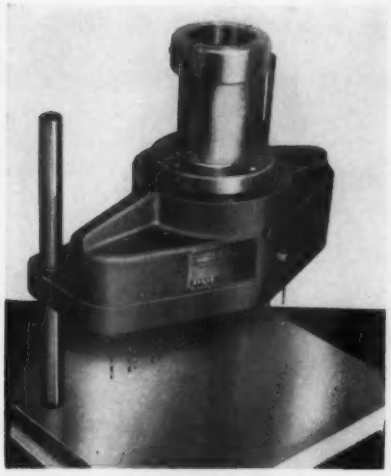
Deep-Jaw Autovise Has 6-in. Air Stroke

Model 666 air-powered, Vi-Speed Autovise has 6 x 6-in. jaws, a 5-in.-OD push rod, and a 6-in. air stroke. Unit develops 1900-lb gripping force at 100-psi line pressure.

Model, with maximum opening of 8 in., is designed for use in light milling or forming, for all production drilling and tapping requirements, and as an air clamp on cutoff saws. It can be used as a compact, bench-type platen press for small jobs.

Van Products Co, 5712 Old Ridge Rd, Erie 7, Pa

MORE DATA? Circle FYI 68, inside back cover



Gearless Drill Heads

Series of in-line drill heads has been added to Zagar Tool's line.

New units are for drilling, tapping, or reaming holes in a straight line in an elongated pattern. Any diameter in any machinable material as close as the sum of the two smallest hole diameters can be drilled, reamed, or tapped. Simultaneous multiple-hole drilling in a straight line reduces drilling time and fixturing costs, in addition to reducing number of machines required for some jobs.

Capacities of the new series are holes arranged in a straight line 13, 15, and 26 in. long. Drill sizes are ⅛ to ¾ in.

Zagar Tool, Inc, 24000 Lakeland Blvd, Cleveland 23, Ohio

MORE DATA? Circle FYI 69, inside back cover

Hollow-Shaft Vertical Motors

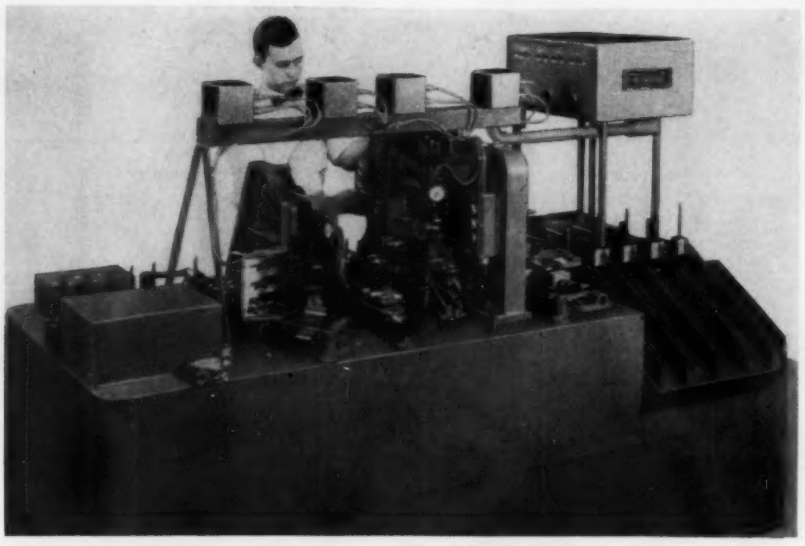
Line of hollow-shaft vertical motors, designed specifically for the pumping industry, is available now in ratings of 40 hp and up, in frame sizes 404 through 6330 (ratings from 7½ hp and up in early 1956).

Easier installation, inspection, and maintenance has been achieved by use of a lightweight cap which can be lifted by one man. When cap is removed, couplings and bearings are available for inspection, and all installation attachments and impeller adjustments can be made without further disassembly. Motors are designed so that couplings can be changed in a few minutes with ordinary tools.

Lubrication is simplified by a new Vistamatic lubrication center providing an oil gage, easily read, and ample filler and drain plugs to facilitate adding and draining lubricant with minimum of danger to motor.

General Electric Co, Medium Induction Motor Dept, Schenectady 5, NY

MORE DATA? Circle FYI 70, inside back cover



Gage Checks 20 Dimensions On 13 Sizes of Stator Blades

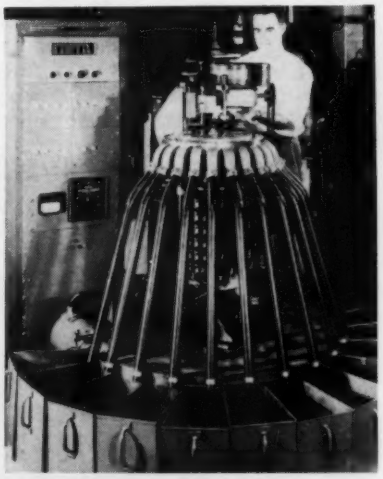
Fully automatic, 4-station, in-process sorting gage, designated Model 144 B-34 measures 20 dimensions on jet engine blades 2 to 6 in. long. Operating at a speed of 0-40 pieces per minute, it directs reject parts out of the line, permits only good parts to pass on to a conveyor.

Device, an integral part of an automatic factory, is conveyor-fed and mounted in the continuous line. A walking beam moves work through the gage. All measuring is done with the work at rest, and gaging units in forward position. Resultant size signals operate colored tolerance lights in power unit and set a synchronized "memory" for later sorting.

Semi-finished blades (12 stages and 1 exit) are checked for: tongue thickness; tongue projection; angle at top of base; base height; base width; leading edge location; blade length at centerline; angle at end of blade; air foil location; blade angle; warp angle; base length; and base end angle. Some dimensions are duplicated at different locations on the blades.

Federal Products Corp 1144 Eddy St, Providence 1, RI

MORE DATA? Circle FYI 71, inside back cover



Precision Automatic Gage Sorts Ball Bearings

Completely automatic, hopper-fed electronic gage measures the OD of precision ball bearings ¼ to 17/32 in. and sorts them into 12 good classifications to each 0.00001 in. plus oversize and undersize. Operating speed is adjustable to sort bearings up to 24,000 per hr.

Another gage of similar design operates at lower speed to measure wider range of balls, 1-mm to 1-in. OD.

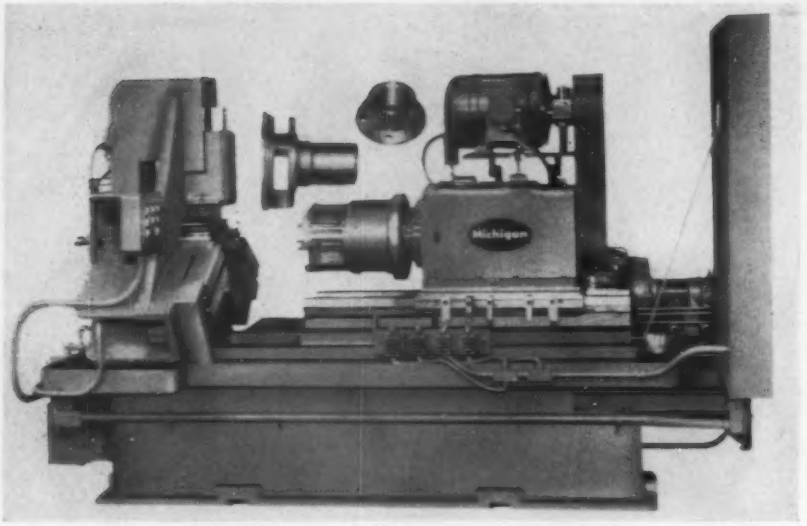
Both gages are automatic—operator fills hopper and presses start button, gage then measures and sorts according to diameter.

From rotary hopper balls drop into one of the 8 holes in the rotating index wheel. Size is found by electronic gage head and amplifier and signal is transmitted to correct OD size station in classifier which causes a mechanical memory to be set.

Gage-sensitive contact retracts and the index wheel transfers the ball to the large wheel which carries it around to the correct size disposal chute.

Federal Products Corp, 1144 Eddy St, Providence 1, R I

MORE DATA? Circle FYI 72, inside back cover



High-Speed Gun Drill

Machine drills 6 holes (0.5102-0.5107 in diameter) in a carrier gear. Drills to size within 0.005, and to location within 0.001. It reportedly produces 400 parts in an 8-hr shift, requiring no further operations.

Unit is designed to handle three totally different parts, from 12 down to 6-in.-dia, without complicated changeover; it can be converted in three minutes. Handles double-flanged parts with flange facing up to 2 in. High-speed production is maintained by a jump feed to cut down cycle time; operates rapid advance to the first flange, then feed through; rapid advance to the second flange, feed through; and rapid return.

Horizontal, way-type unit has hydraulically operated bushing position slides; automatic lubrication throughout; special high-pressure coolant system; built to JIC standards.

Michigan Drill Head Co, PO Box 4643, Detroit 34, Mich

MORE DATA? Circle FYI 73, inside back cover

20-in. Disk Grinder & Sander

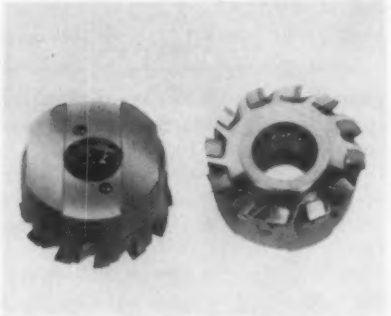
Model 20 Apex disk grinder and sander can be used for working metal, wood, or plastic. Single motion adjusts table up or down. New, counterbalanced mechanism eliminates slow, frequently dust-fouled rack and gear adjustment. Reverse switch is conveniently located to speed RH and LH jobs and increase disk life.

Wrap-over guard cannot flip off, and tilts back to handle work at top of disk. Guard design, plus impeller-type disk, is said to actually throw dust into bag. All moving parts of the grinder are lifetime dry-lubed. Motors are totally enclosed or equipped with sealed bearings. Table can be tilted accurately from any 45° angle up or down, and locked into position. Once finished, table can be squared automatically.

Model, with a year's guarantee, is priced at $354 with a 1-hp motor, $386 with a 2-hp.

Rankin Bros Engineering & Sales Corp, 11104 S Alameda, Lynwood, Calif

MORE DATA? Circle FYI 76, inside back cover



Boring Cutter's Blade Locking, Adjustment Mechanisms Enclosed

Inserted blade boring cutter is designed so that all blade locking and adjustment mechanisms are totally enclosed during cutting. Arrangement protects devices from heat-hardened dirt, oil, and cast iron dust.

Locking mechanisms on the front of the cutter are enclosed by the flange of the hold-in screw which seats against the front hub of the cutter. On the back, adjusting screws for setting out blades are enclosed in the tapered bore of the cutter, which fits against the tapered pilot of the spindle. Mechanisms are readily accessible when cutter is not mounted on the spindle.

Design of the tool makes it possible to increase the number of blades in small diameter cutters. Number is determined by feed rate, chip load, and bore size, and may vary from 6 to 12 carbide-tipped blades per cutter.

Ingersoll Milling Machine Co, Rockford, Ill

MORE DATA? Circle FYI 74, inside back cover

Geared motor, open type, for overhanging or radial thrust loads incorporates double supported gear shafts running in sintered bronze bearings, heavy-duty gears and output shaft, and helical pinion and gear in the first step. Synchronous or non-synchronous unidirectional, or non-synchronous reversible base motors available; starting torques up to 75 lb-in., and gear ratios from 4:1 to 30,000:1. Bulletin F-6841.

Barber-Colman Co, Small Motors Div, Rockford, Ill

MORE DATA? Circle FYI 75, inside back cover

Synthetic sapphire balls are available in 11 standard sizes from 1/64 to 3/8 in., including 1 mm. Prices range from 25¢ to $7.60 each in quantities of 1 to 100. Balls are said to have excellent corrosion and abrasion resistance, and extreme hardness. Compressive strength is 300,000 psi; water absorption, zero; 3.98 spg. Made to tolerance of ± 0.0001 in. on size and 0.000025 in. on sphericity; surface roughness of less than 1 mu-in.

Industrial Tectonics, Inc, Ann Arbor, Mich

MORE DATA? Circle FYI 77, inside back cover

There is a Kodak Contour Projector for every inspection and measurement job

- To reduce costs
- To speed the work
- To improve accuracy

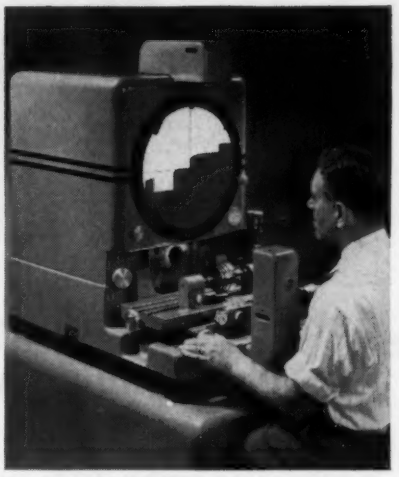
Whether you use optical gaging in the toolroom, on the production line, in assembly, or in final inspection, there is a Kodak Contour Projector designed to meet your needs.

The Model 2A and Model 30 Contour Projectors are precision measuring instruments, especially suited for toolroom use, for inspecting parts to determine machine settings, for grading components for selective fit.

The Model 3 and Model 4 Contour Projectors are critically accurate optical comparators, designed to check complex parts quickly in quantity.

All Kodak Contour Projectors have bright screen illumination, requiring neither hoods nor curtains. All offer a choice of six lenses, from 10× to 100×, mounted alone or in turret for instant changes of magnification. All can be equipped with the Kodak self-contained surface illuminator, for checking blind holes and surface details unsuited for shadow projection.

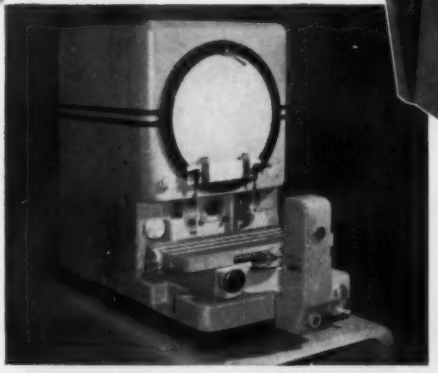
To find out how the right Kodak Contour Projector can speed work, reduce costs, and improve accuracy in your own plant, send for your copy of "Kodak Contour Projectors."



Model 2A—*for precision measurement.* First choice in the toolroom, the Model 2A is equipped with micrometers graduated in ten-thousandths of an inch. Protractor ring permits measuring angles to plus or minus one minute of arc.

Model 3—*for fast production inspection.* Designed to provide accuracy at low cost, the Model 3 is intended for use with special staging fixtures in checking long production runs. Vertical beam unit, supplied as accessory, expedites inspection of flat parts.

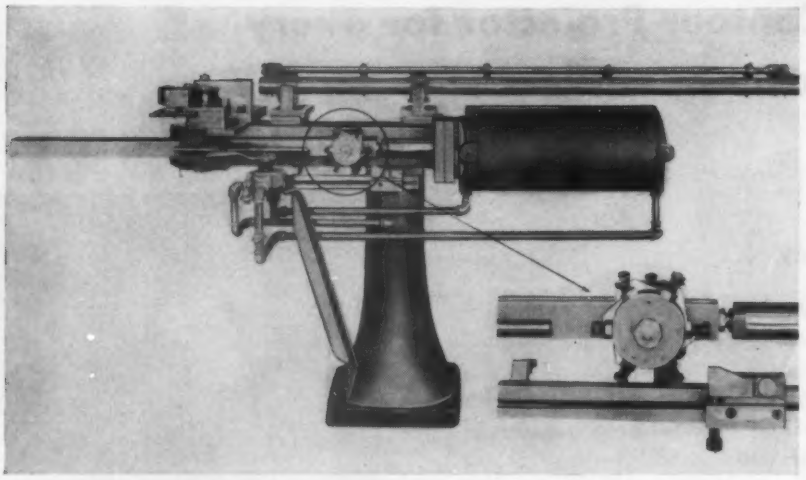
Model 30—*for handling large parts.* King-sized counterpart of the Model 2A, the Model 30 offers a full 17-inch throat clearance for large parts, 30-inch viewing screen, 8-inch table travel in both vertical and horizontal planes.



Model 4—*for inspection versatility.* Similar to the Model 3, the Model 4 is equipped with a movable table to simplify fixturing, permit ready change-over from one part to another. Available with or without vertical beam unit.

EASTMAN KODAK COMPANY
Special Products Sales Division, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR



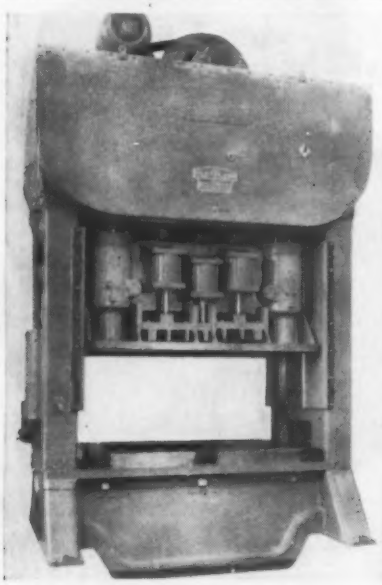
Automatic Ratchet Unit For Tube Bending Machines

Automatic turret attachment, designed for the Bend-Ex Bender, can be set to make a number of different angle bends automatically.

Standard turret has six stations; more or fewer stations can be furnished. Operator sets it in the same manner as a manual turret, but on the return stroke of the rack, a ratchet engages the index finger and advances the turret automatically to the next position. Turns are adjustable longitudinally on the rack to accommodate different setups. Index finger unit is de-mountable for manual operation when desired. Unit can be mounted in an hour on regular models, or furnished on new machines for slight additional cost.

Paul Machine Tool Co, 4600 S Kedzie, Chicago 32, Ill

MORE DATA? Circle FYI 78, inside back cover



Cleveland Four-Point Press

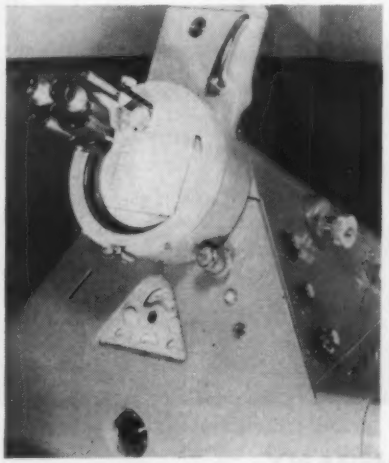
Cleveland S4-500-108-72 four-point press, double geared, is equipped with single station, electrically controlled drum-type air friction clutch and arranged with air-operated bar knock-out.

Slide is provided with air counterbalance; flywheel is fitted with auxiliary air brake to permit quick stop. Bed is equipped with one set of 2 air cushions with combined capacity of 100 ton psi, and has 10-in. stroke.

Unit has capacity of 500 ton, a 20-in. stroke with 14-in. adjustment, and a shut height of 40 in. Area of bed and face of slide is 72 x 108 in.; variable-speed motor operates slide at 7 to 14 strokes per minute.

Cleveland Punch & Shear Works Co, Cleveland 14, Ohio

MORE DATA? Circle FYI 79, inside back cover



Front-End Camera and Attachment For Electron Microscopes

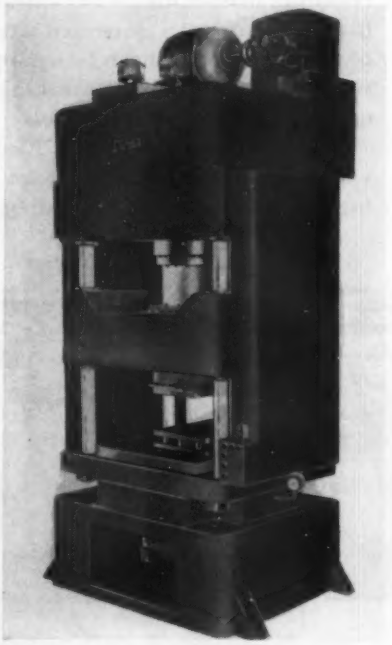
New front-end plate camera and binocular attachment, both adaptable to all existing Philips EM-100 electron microscopes, has been developed by North American Philips Co.

Unit permits micrographs to be made at direct magnifications up to 100,000X direct at the viewing screen. Cassette holds five 3¼ by 4-in. or six 4 by 5-in. cut films. Rapid single lever action removes cassette from field, and presents fresh film, eliminating double exposures. Camera is equipped with a direct-reading exposure counter.

Binocular attachment fits over flange ring of Philips 100 Kv electron microscope. Objective lenses provide 3.5 and 7X magnification, and aid in determining accurate image focus.

North American Philips Co, Research & Control Instruments Div, 750 S Fulton Ave, Mt Vernon, NY

MORE DATA? Circle FYI 80, inside back cover



Single-Action 300-ton Press

Model 300 hydraulic unit is electrically controlled for either automatic or semi-automatic operation. Slide return may be controlled by either pressure or length of stroke setting; it may be inched up or down, or the press manually operated when slide is in the up position. Pump bypasses at zero pressure.

Single-action, open-rod press may be supplied with hydraulic cushions in the bed for metal drawing applications. Unit is available in tonnage capacities of 50, 100, 150, 200, or 300 ton.

Clifton Hydraulic Press Co, 288 Allwood Rd, Clifton, NJ

MORE DATA? Circle FYI 81, inside back cover

announcing A NEW NEW BRITAIN +GF+ COPYING LATHE

designed for the highest production jobs in the world

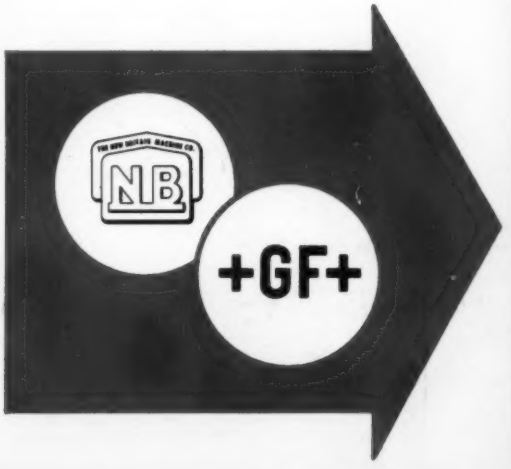
THE New Britain **+GF+** Copying Lathe was originally designed as a highly versatile quickly-tooled machine, which is available in eight different models, and is an outstanding profit maker on both short and long runs.

Now New Britain has added two new models, the $11\frac{1}{28}$ and $11\frac{1}{40}$ which successfully apply the basic principles of this new approach to copy turning, to the highest production applications in metalworking history. One of these new machines, a typical work piece and diagrams of the operations performed, are shown on the two following pages.

If you have work that requires contour turning and facing, the New Britain **+GF+** has basic profit-making advantages. You should know about them, regardless of whether your needs call for small lots, or automated long-run production.

A NEW APPROACH TO COPY TURNING is the title of a new color motion picture which is available for showing in your plant. Ask your New Britain Representative, or write The New Britain Machine Company, New Britain, Connecticut.

(See the following two pages for more details)



New High-production New Britain +GF+

. . . continued from preceding page

a new approach to important savings

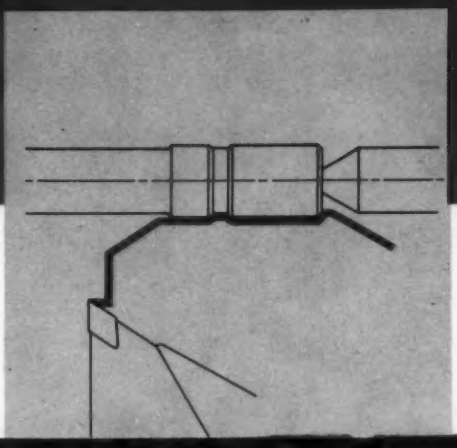
For the typical rear axle shaft illustrated, a double carriage design plus infeed attachment permits machining both ends at once, eliminating wasteful idle time.

This new copying lathe features pick-off change gear headstock, combined with a selector lever for high and low spindle speed range. Its basic advantages of template control, easy chip removal and elimination of expensive form tools are readily adaptable to a wide variety of work which ordinarily would require many more tools, and, in some cases, further operations on additional machines. Get the facts from your New Britain Sales Representative or write the factory.

The NEW BRITAIN MACHINE COMPANY

Copying Lathe . . .

on your "expensive" pieces



New Britain-Gridley Machine Division, New Britain, Connecticut • Lucas Machine Division, Cleveland 8, Ohio

• AUTOMATIC BAR and CHUCKING MACHINES • PRECISION BORING MACHINES
• LUCAS HORIZONTAL BORING, DRILLING and MILLING MACHINES • NEW BRITAIN +BF+ COPYING LATHES

Steel body using Yoloy "E" for it's greater strength. This truck was developed for carrying large advertising signs.

QUALITY
YOUNGSTOWN
SERVICE

Here's a high-strength low-alloy steel that's *easy to fabricate*

All Hi-strength steel unit for beverage deliveries.

Truck made entirely of Yoloy "E". This is a pallet type with sliding steel doors, mounted on standard chassis.

IT'S Yoloy "E", one of the Youngstown family of low-carbon, nickel-chrome-copper steels that are easy to fabricate, easy to weld.

Specialty Engineering Co. of Philadelphia, for example, reports that Yoloy will take a 180-degree bend without developing edge cracks. And material at the weld and immediately next to it has the same high quality as the parent metal.

The customer gets other advantages, too. With Yoloy steels, you can design with lighter gauges and have the same strength. On trucks, like those illustrated, it means more payload, less deadweight. High resistance to corrosion of Yoloy "E" means longer life and less maintenance. And it has high resistance to shock and vibration.

Whatever you fabricate, chances are you can benefit by using one of the Yoloy family of steels. Yoloy is available in sheets, plates, strip, pipe, mechanical tubing, bars, shapes and cold finished bars. All made by Youngstown.

Photos courtesy of Specialty Engineering Co.

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices Youngstown, Ohio District Sales Offices in Principal Cities.

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - BLACK PLATE - RAILROAD TRACK SPIKES - MINE ROOF BOLTS

In announcing the new Electric Power Feed for their popular No. 601 "RAPIDUCTION" Turret Lathe, Oster Manufacturing Company of Cleveland emphasizes that within its speed range, an infinite number of feeds are available for most efficient chip removal and surface finish desired. Better performance and increased production result.

The electrical heart of this unique mechanism is a General Radio Type 1701-AM VARIAC Motor Speed Control. This Control operates from the 115-volt a-c power line, converts to d-c and varies the speed on a 1/15th hp d-c shunt-wound motor, and provides continuously-adjustable, infinitely-variable speed to the carriage rack and pinion to a cone clutch spur and gear reduction.

The lathe power feed operates entirely independently of the spindle drive motor and can be disengaged at any time for ordinary hand feed.

Oster has found the smooth operation, compactness, reliability and very low maintenance of the VARIAC Motor Speed Control deciding factors in its incorporation into the design of this important auxiliary to their line of lathes.

Other manufacturers and users of machine tools have learned the many important advantages to be gained with

Variac® Motor Speed Controls

- **Wide Speed Range** — at constant output torque
- **Extra Quick Start-Stop-Reverse** with heavy loads
- **Dynamic Braking** on all of the larger models
- **No Electronic Tubes** — no warm-up time — always ready to go
- **Perfectly Smooth Control** — with good regulation
- **Very Long Life** — with minimum and simple maintenance
- **Low Cost** with simple installation

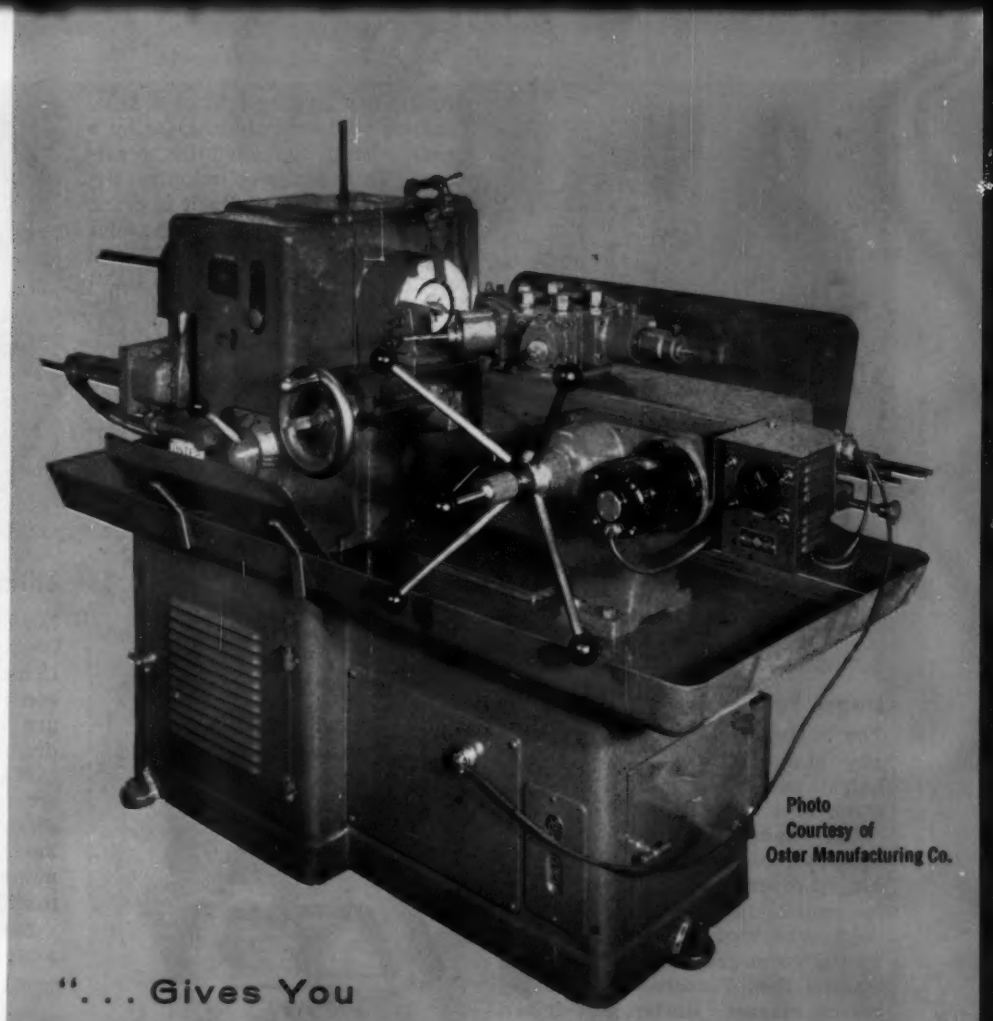
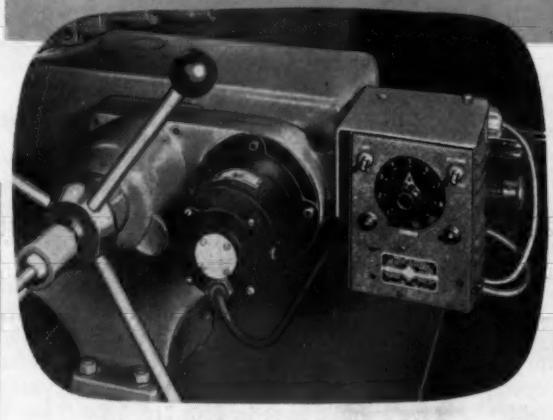


Photo Courtesy of Oster Manufacturing Co.

"... Gives You

Better, More Productive Performance

and **Greater Reliability"**



Type 1701-AK VARIAC Motor Speed Control for 1/15th hp shunt-wound d-c motors. It is equipped with Speed Control knob and dial, "REVERSE-FORWARD" switch, line switch, 0-1725 and 0-3450 rpm range switch, slow blow fuse and indicating pilot light. Its cabinet is readily mounted on a bench or wall, or assembled as an integral part of any machine. Price: $75.00.

Fifteen other VARIAC controls are available in hp ratings from 1/15th hp to 1½ hp, both in cabinet and stripped-down models.

Write for* THE VARIAC MOTOR CONTROL BULLETIN *for Complete Data

WE SELL DIRECT. Prices are net, F.O.B. Cambridge or West Concord, Mass.

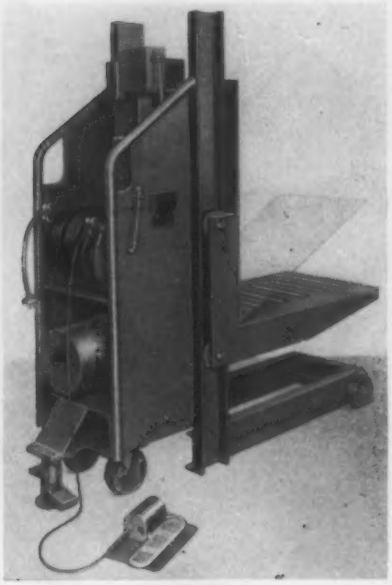
GENERAL RADIO Company

275 Massachusetts Avenue, Cambridge 39, Massachusetts, U. S. A.

1915-1955

40 Years of Pioneering in Electronics

90 West Street NEW YORK 6
8055 13th St., Silver Spring, Md. WASHINGTON, D. C.
1150 York Road, Abington, Pa. PHILADELPHIA
920 S. Michigan Ave. CHICAGO 5
1000 N. Seward St. LOS ANGELES 38



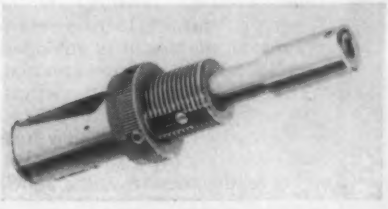
Larger Portelvator

The Portelvator S, Hamilton manually operated stacker for lifts to heights of 58 in. or less above floor level, now has a larger companion.

The new unit has a roller-equipped platform 20x36 in. with hinged cover plate and uses electric-mechanical lift through 3-hp crane hoist type motor, feeding through worm, worm gear, and screw power transmission. Features include: reversing magnetic starter; gear-driven limit switch; retractable power cable on 15-ft. spring reel; and retractable reversing foot switch on 25-ft. spring reel. The platform operating speed is 58 ipm. Platform travel is 41 in. with minimum height of 7 in. and maximum height of 48 in. Load capacity of the machine is 3000 lb.

Hamilton Tool Co, 826 S Ninth St, Hamilton 1, Ohio

MORE DATA? Circle FYI 56, inside back cover



Adjustable Tap Drivers Have One-Piece Floating Holder

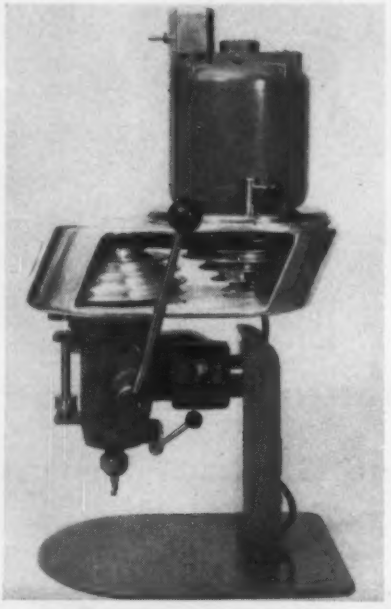
Two improved tension and compression tap drivers have been developed for use in spindles taking adjustable adapter shank tools. Both are self-adjusting, by spring-action, to variation of feed between spindle and tap. Tension-type is designed for use when spindle feed is less than feed of tap; compression model, when speed is greater.

Floating holders provide added strength and rigidity to nose of float. Taps are held securely in place by a trepan clamp tightened by a set-screw. This design eliminates the hex nut which was difficult to work with in close center operations, and would, occasionally, twist off the nose of the float if turned too tight. Both models shear the driving pin before stripping part threads, or damaging any spindle or holder parts.

Diameters are held to 0.0003 in., and total concentricity 6 in. from the nose is held to within 0.002 in. (total indicator reading). Threads on adapter body are ground to insure Class (2) fit with Seibert micro nuts. Shank and thread size, ½ in.-16 to 1⅜ in.-12; shank length, 3 to 4⅝ in.; stroke, ½ to 1 in.

Seibert & Sons, Inc, Chenoa, Ill

MORE DATA? Circle FYI 57, inside back cover



Universal Head Converts Horizontals to Vertical Mills

Universal vertical head has been developed to convert horizontal machines to all-angle vertical mills.

Self-contained, independent, 5-speed, motor-driven unit can be positioned angularly with spindle lever-locked in any position. Micrometer adjustment on quill front gives operator complete cutting measurements up to 0.001 over a 2-in. travel.

Five spindle speeds, 390, 710, 1200 2500 or 5200 rpm, are provided by a 1/3-hp, 110-v, single phase, reversible motor located above belt housing. Standard Y-type collets are available from 3/16 to 1/2 in.

Rotex Punch Co, 2350 Alvarado St, San Leandro, Calif

MORE DATA? Circle FYI 58, inside back cover

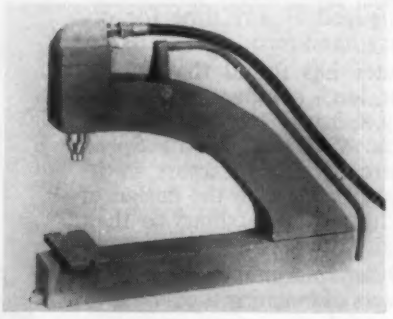
Tilting Tumbling Machine

Model H Oblique tilting machine is designed with few moving parts. Controls and adjustments are conveniently located and bottle barrels are easily emptied by manual-hydraulic or power tilting.

Machine occupies small floor space, and is offset on base for solidity. Motor acts as balance for load. Barrels of different shapes and materials may be mounted on the machine to suit requirements.

Baird Machine Co, Stratford, Conn

MORE DATA? Circle FYI 59, inside back cover



Pneumatic Punch

Lightweight, lowcost Air Champ delivers up to 200 strokes per minute. Machine staples, eyelets, stakes, swages, crimps, stamps, marks, cuts, and clamps. Rejects are reportedly reduced to absolue minimum.

Unit comes with valve, bolster plate, and foot treadle, ready to mount and use. Tools can be changed immediately. Single ½-hp compressor furnishing 1½ cu ft of air per minute can operate eight Air Champs simultaneously, each delivering a working stroke every second. Model weighs 12 lb, has a 10-in. throat, is priced at $79.

Jet-Heet, Inc, Pneumatic Tool Div, 152 S Van Brunt St, Englewood, NJ

MORE DATA? Circle FYI 60, inside back cover

"J&L 1200" Steel provides the qualities that help machine operators do top-flight work at lower overall costs. With "J&L 1200," the operator obtains: better machine finishes . . . longer tool life . . . higher rates of speed. This fact has been proven time and again—in shop after shop.

"J&L 1200" grades meet the compositions published by the A.I.S.I. . . . S.A.E. . . . and Federal Specifications QQS-633.

Try this steel in your own shop. Results will convince you "J&L 1200" deserves to be a regular specification for your production runs.

Jones & Laughlin
STEEL CORPORATION — *Pittsburgh*

J&L STEEL

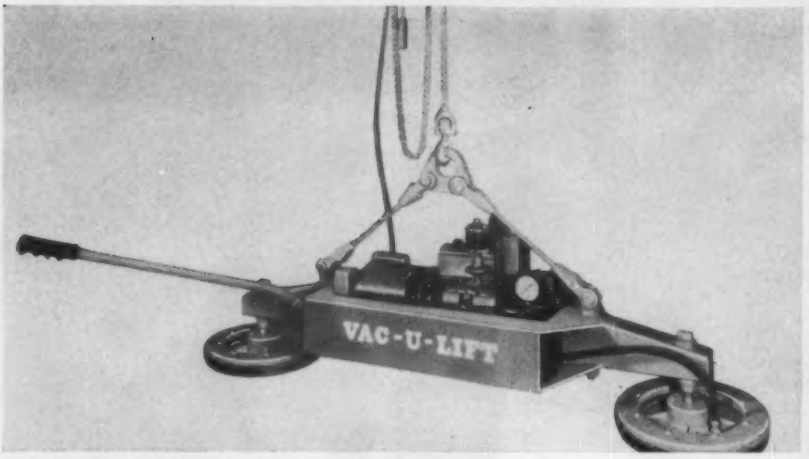
TOPS
IN COLD FINISHED
CARBON STEEL BARS

"J&L 1200"

Use "J&L 1200" steel on your tough jobs for . . .

tops in quality *tops* in uniformity
tops in machinability *tops* in finish

available in all standard shapes and sizes



Materials-Handling Device Operates on Vacuum Principle

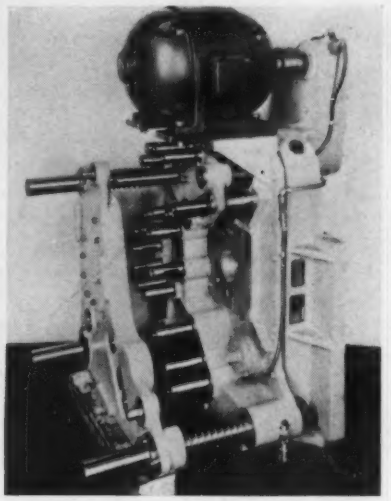
Vac-U-Lift, designed by Blakeslee Manufacturing Co, Salem, Ill, incorporates large vacuum pads which grip materials for handling.

Unit will lift any object with a non-porous surface that is large enough to allow pads to attach themselves. Each pad has a lifting power governed by its diameter. Device can reportedly handle weights up to several tons with an ample safety factor.

Small hand models and units with curved vacuum pads are available for special lifting and handling jobs. Standard units are furnished with single, twin, and multiple heads. Models can be designed to meet specifications for special usages and weights.

Distributed by International Staple & Machine Co, Herrin, Ill

MORE DATA? Circle FYI 51, inside back cover



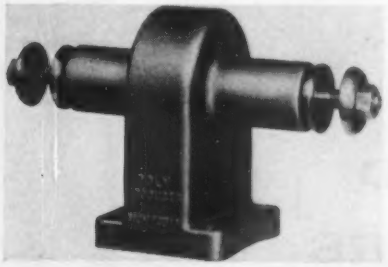
Multiple-Spindle Head

Special fixed-center multiple-spindle drilling and tapping head, with spring-loaded suspended drill bushing plate, was custom-built by Thriftmaster Products for simultaneous drilling and tapping of parts in conjunction with a rotary indexing table.

This is a 19-spindle head; 11 are used for drilling and countersinking, 8 are leadscrew tapping spindles, driven by a separate motor mounted on housing of the head. All are geared to correct speed for specific operation being performed.

Thriftmaster Products Corp, 1016A N Plum St, Lancaster, Pa

MORE DATA? Circle FYI 54, inside back cover



Bench Grinder for Light Work

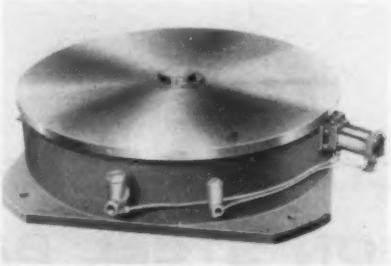
Model D4, designated "Stubby," is a smaller copy of the larger, heavier multi-purpose grinders manufactured by Poly Products. It is said to be particularly applicable where slower or faster-than-normal motor speeds are required.

Housing of the 5-lb unit is cast aluminum alloy. Shaft is precision-ground steel balanced on ball bearings, New Departure, or equivalent. Sealed bearings are permanently lubricated, and pressed-on pulley is 2-step.

Housing is open in back and base for either rear or under-table drive. Spindle size is ½-in.-dia x 11⅛ in. long. Thread is ½-20NF. Wheel capacity is 6 in.

Poly Products Co, 230 E Pomona Ave, Monrovia, Calif

MORE DATA? Circle FYI 52, inside back cover



Indexing Table

Air-operated rotary table provides positive index with loads up to 500 lb. Heavy cast wall serves as bearing for table top, insuring rigidity.

Table has no gears, ratchets, fragile parts. Both turning force and stopping power are applied at outer circumference, rather than at center. This reportedly provides more torque for turning and more leverage for stopping, so that less air pressure and power are needed. Unit operates on pressure of 60 to 100 lb. Hydraulic adjustable control assures cushioned stops under all load conditions; additional simple control adjusts speed of indexing. Once set, no further adjustments are necessary. Model is available in 26-in. size with either 6, 8, or 12 stations.

Pitt Industries, Carnegie, Pa

MORE DATA? Circle FYI 53, inside back cover

Minute Man Hexagonal Broaches

HSS, push-type hexagon broaches have been added to the Minute Man line; they are available in eight standard sizes from 3/16 to ¾-in. hex.

Starting with a round pilot, broaches will finish a full hexagonal hole in a drilled, reamed, or cast bore in a single pass in less than a minute. They may be used in either a hand-operated arbor press, or a hydraulic press, and are reportedly particularly advantageous in tool and die work, in sizing work, and for hexagonal couplings.

The du Mont Corp, Greenfield, Mass

MORE DATA? Circle FYI 55, inside back cover

see how GREENLEE DOES IT!

VISIT BOOTH No. 1221 AT THE 1955 MACHINE TOOL SHOW

See this production problem solved on a Special Greenlee Bar Automatic. It will be in normal production operation here at the show.

GREENLEE CAN HELP SOLVE YOUR PRODUCTION PROBLEMS

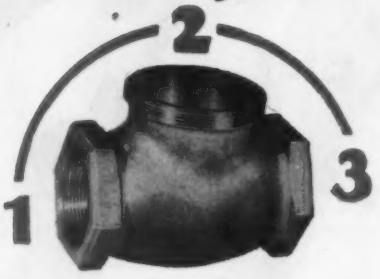
The creative know-how that built this special auger-bit machine is available to you. Make full use of Greenlee specialized engineering skills and ingenuity. Take advantage of its cost saving possibilities.

GREENLEE

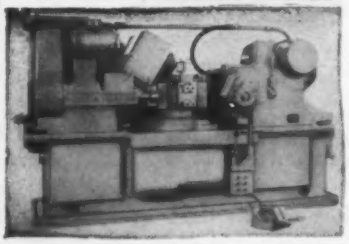
GREENLEE BROS. & CO.
1728 MASON AVE.
Rockford,
Illinois

write for further information

Single set-up covering
ALL finishing operations...
MEANS GREATER ACCURACY *with* **GOSS DeLEEUW**



AUTOMATIC CHUCKING MACHINES



One of the many important advantages being realized with this new chucker is the performing of ALL finishing operations on a single chucking of the work. In addition to the time saved, this feature, exclusive with Goss & DeLeeuw "1-2-3" machines, means only one handling of the work with an attendant greater accuracy. This machine is in a class by itself in precision finishing.

In Goss & DeLeeuw "1-2-3" Automatic Chucking Machines, one, two, or three ends of the work are machined simultaneously or in sequence. There is no need for resetting, retooling or secondary operations. More work from one machine and greater accuracy are matters of record.

Ask for illustrated literature describing the operation of this chucker in detail. Send samples of your work for time and cost estimates.

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

GOSS & DeLEEUW
QUALITY PRODUCT-QUANTITY

What's Down South? . . . *continued*

Companies moving into North Carolina are thus presented with an opportunity for building an entirely new concept of employee relations. Here there are no ancient grudges to be paid off, no rankling memories of the brutal strike-breaking tactics of a few decades ago, no scars left by financial crises and lost business brought about by labor stoppages. The slate is clean, and both teams—management and labor—are free to start on an even footing.

In such a situation, management has the most to gain—and the most to lose. And management has not been slow in appreciating the opportunity. Remembering the mistakes of past generations, it is starting out with the premise that employees are people; and that people have feelings, personal problems, and personal responsibilities. With a few notable exceptions, such a consideration has been unusual in industrial areas, and it is only in quite recent years that it has begun to make any progress. It is not new in the South. Reynolds Tobacco Co, for example, has had for many years a personnel counselor—commonly called the Chaplain — to whom any employee may go at any time with his or her problems. A request to a foreman that, "I want to see the Chaplain" must be honored without question and without any penalty for lost time.

The Problem of Skills

With the exception of top management and a few key supervisors, all the labor force in the new plants is recruited locally, and many, perhaps most, of the new employees have never before seen metalworking equipment. As events have proved, training has presented few problems, and training directors are astonished at the speed with which the new skills are acquired. Admittedly, modern high-production equipment calls for greater specialization and a shorter, if more intense, training period, but a native dexterity and a sincere desire to learn have been the major factors.

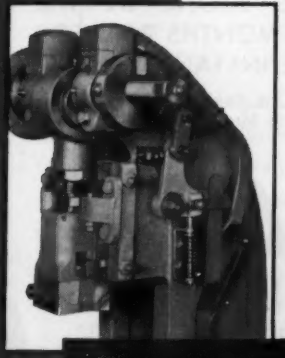
In-plant training programs have, thus far, solved the problem for the larger plants, but smaller companies wishing to locate in the area may still face something of a dilemma if they cannot afford to institute such programs. There will, of course, be some leakage from the larger plants, but this will not be sufficient to meet the demand, and there are not,

BIG NEWS!
FOR PUNCH PRESS USERS!

A complete NEW Line of Low Cost **benchmasters** with INCREASED TONNAGE!

LATEST IMPROVEMENT!

Benchmaster is now equipped with this oversize *sliding key type clutch dog contained in a husky hardened steel collar*...takes load off the crankshaft keyway—insures trouble-free performance for years to come!



Yes, you get more of *everything* in the new Benchmasters. More experience, more performance, more satisfaction, more improvements, *and now a great new addition...MORE TONNAGE!*

Benchmaster's brand new line includes a whole new series of presses, partially illustrated here, available in both plain and back-geared types as well as half-presses.*

See these at your dealer's and compare prices. You'll see why Benchmaster has been America's favorite punch press for nearly two decades!

**2 Ton in Plain O.B.I. Type only*

1835 W. Rosecrans Avenue
Gardena, California

benchmaster

World's largest manufacturer of small punch presses and mills.

McCaskey Tool Crib Control installation in the Elyria, Ohio plant of The Pfaudler Co., prominent manufacturer of glass lined, glassed steel and stainless steel tanks, pressure vessels and other process equipment.

McCaskey Tool Crib Control produces *QUICK RETURN* on Pfaudler Company investment

Mr. C. S. Rieley, Chief Industrial Engineer of The Pfaudler Co., Elyria, Ohio, states:

"McCaskey Tool Crib Control was installed here in 1950. Tool purchases were reduced $1800 during the first year.

"At the start of operations 3,757 expendable tools such as drills, taps and reamers having a value of $5375 were turned in to the crib. In addition, more permanent types of tools such as chucks, boring bars, sleeves, etc. valued at over $3000 were recovered.

"Another significant saving resulted from elimination of idle machine time while operators searched for tools.

"The McCaskey Tool Crib system provides us with fast, reliable service, allows the attendant ample time to regrind and maintain the tools in properly sharpened condition, keeps tool stocks at a workable minimum and helps reduce breakage through simple control records.

"SAVINGS IN REDUCED TOOL PURCHASES ALONE IN THE FIRST FEW MONTHS PAID FOR THE ENTIRE INSTALLATION."

Mail coupon for further evidence that McCaskey Tool Crib Control quickly returns its first cost in continuing savings in plants both large and small.

Victor Adding Machine Co.
McCASKEY INDUSTRIAL DIVISION
3900 N. Rockwell Street
Chicago 18, Ill.

Please send me all the facts concerning McCaskey Tool Control ☐; Gage Control ☐; Blueprint Control ☐.

Name .....

Position .....

Company .....

Address .....

AM-8-15-55

McCaskey
INDUSTRIAL CONTROLS
TOOLS - PRODUCTION - COSTS
MAINTENANCE - INVENTORY
Victor Adding Machine Co.,
McCASKEY INDUSTRIAL DIVISION
3900 N. Rockwell Street, Chicago 18, Ill.
Galt, Ontario, Canada

What's Down South? . . . *continued*

as yet, adequate vocational classes provided by the state for instruction in the metalworking trades. From the state government standpoint it comes down to the old problem of the chicken and the egg. It is useless to operate vocational schools unless there are adequate job opportunities to absorb the graduates. On the other hand, smaller companies cannot be expected to move into the area without the assurance of a reserve of available skilled labor. The problem is further aggravated by the very decentralization program which is designed to attract industry to the smaller communities. It is obviously impractical to operate many small vocational schools for a few students. Yet young people cannot be expected to travel to a larger school in a distant city and to pay travel and living expenses. Moreover, once accustomed to the city, many of them would tend to seek local employment rather than return to their own communities. This would bring about the very situation it is desired to avoid—a surplus of labor in certain concentrated areas, with a lowering of wage levels, and a continuing shortage in the areas where new industries are needed. These, however, are but the growing pains of any newly industrialized area. They are being faced squarely at the Capitol and it is evident that a remedy will soon appear.

Who is There?

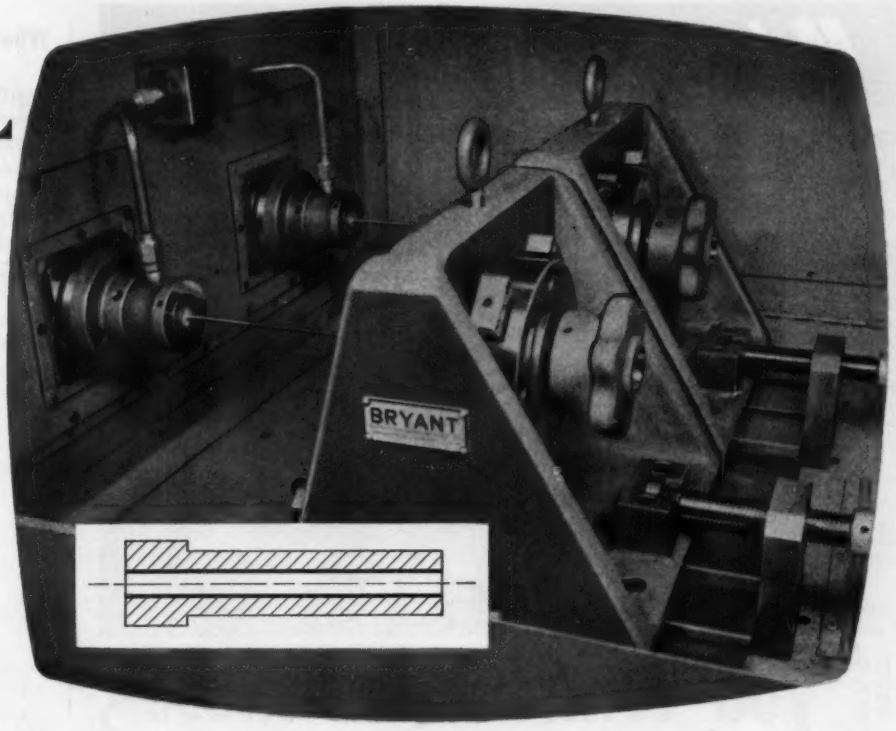
Obviously it is not possible to list all the new plants now in operation or under construction in North Carolina, but some of the major, better-known names are Douglas Aircraft, General Electric, Western Electric, and Westinghouse. The plants concerned are by no means "cottage industries," but large, modern establishments comparable to any to be found in the North. The presence of such plants does not, however, constitute the only new employment possibility. Each attracts to itself a satellite group of smaller industries to act as feeders and suppliers, thus broadening and further diversifying employment.

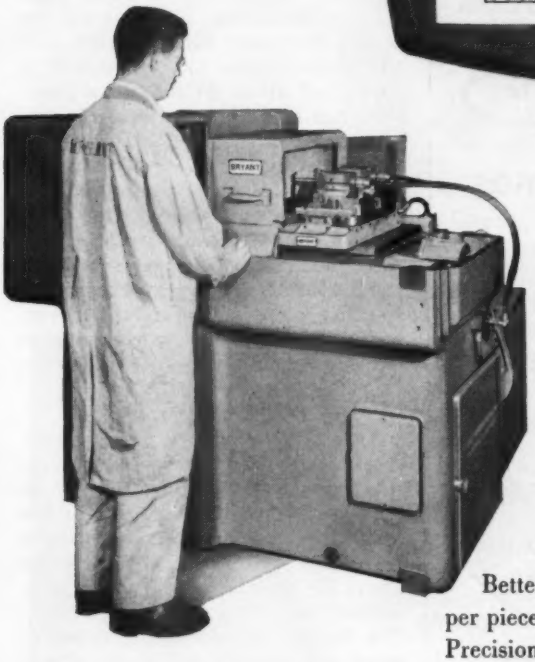
General Electric, for example, now has under way a $20 million distribution transformer plant in the Hickory area. Planned to be in full operation in late 1956, it will employ 1100 persons and will occupy 400,000 sq ft of floor area. All but 100 technicians and specialists from Pittsfield, Mass, will be hired locally.

Why a transformer plant in the

CANCEL

secondary operations on tough drilling jobs like this





with the BRYANT precision boring machine!

Part—Phosphor Bronze Bushing
Operation—Precision drill hole from solid
Hole dimensions—.300 + .002 dia. x 3¼" long
Cutting Speed—5000 R. P. M., 395 S. F. M.
Feed—3.5 I. P. M.
Finish required—8 to 10 Micro-inches
Production—96 pieces per hour at 100%

Better finish, more accurate holes and improved production at lower cost per piece result when difficult deep hole drilling jobs are done on the Bryant Precision Boring Machine.

In many cases secondary operations such as lapping or reaming are eliminated, providing further savings.

The versatile Bryant 998 is designed to allow rapid interchange of fixtures and tooling for machining a wide variety of parts. Its table is actuated mechanically by a precision cam and lever unit—providing constant tool control.

The Bryant pre-loaded ball slide construction supporting the table assures fine finishes and accuracy in precision boring, drilling, turning, facing, grooving and precision contouring. *Write for Bryant 998 Job Folder.*

Be sure to see the Bryant 998 Precision Boring Machine demonstrated at the Machine Tool Show... Booth 1015

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What's Down South? . . . *continued*

Southeast? Simply because GE believes that this area has one of the greatest growth potentials in the country. More people mean more homes, more television sets, more vacuum cleaners and washing machines, and a vast increase in the consumption of electric power — probably double the present average of 2400 kwh per year for each home, farm, and small commercial establishment. And by setting up the new plant, GE not only gains the advantages already discussed, but helps to bring about the very growth on which its decision was based.

Other GE plants already in operation include a lamp wire factory at Goldsboro, and an automatic blanket factory at Asheboro. And construction is well under way on a new outdoor lighting manufacturing plant at Hendersonville. This will be in full operation early in 1956 and will employ some 600 people with a payroll of about $2 million a year. Designed to be the "Outdoor Lighting Center of the World," it will be a completely integrated industrial setup with its own administrative, research, design, engineering, production, and marketing facilities and personnel. Total floor area will be about 200,000 sq ft on a 60-acre site, and the plant will produce street, traffic, flood, and all other outdoor lighting products.

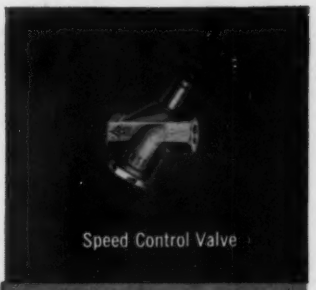
DEFENSE PRODUCTION

Another newcomer is Douglas Aircraft, which is working on a major subcontract for Western Electric to build airframes for the Nike guided missile. This involves taking over a 1¼-million-sq-ft plant, formerly the Charlotte quartermaster depot and, before that, a Ford assembly plant. The factory is now being rehabilitated and modernized by the Corps of Engineers to Douglas specifications and is scheduled for occupancy within the next few months. Production is expected to start early in 1956. Employment figures are not presently avilable but are expected to be in the neighborhood of 1500. Here again, local labor will be employed, except for a few top missile men to be sent from California.

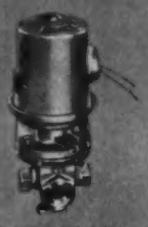
The plant will be highly mechanized and the bulk of the work will be sheet-metal and assembly work. Machine work will be subcontracted locally, and Douglas has already ascertained that there are shops within a reasonable radius that can meet all its requirements. Further details of the plant are restricted.

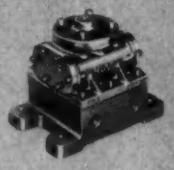
Western Electric's radio division

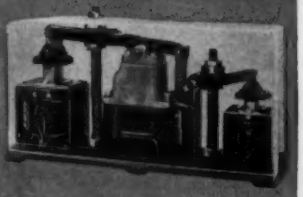
Ross poppet valves
you'll see on equipment at the Chicago Shows

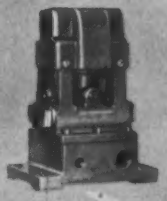

Speed Control Valve

Foot Operated

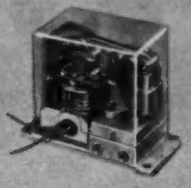

Solenoid Introid (Pilot Operated)


Retrold (Remote Controlled) MV, Pressure Operated


Double Solenoid Direct Operated


Solenoid Introid (Pilot Operated)

Hand Operated


Solenoid Direct Operated

Retrold (Remote Controlled) TD, Sequence Type

Pilot Valve

Solenoid Introid (Pilot Operated) Momentary Contact

Hand Operated

Solenoid Introid (Pilot Operated) Safety

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is already well established in North Carolina, with plants in Greensboro, Burlington, and Winston Salem employing a total of 11,000 people. And nothing could better exemplify the company's belief in the correctness of its choice of location than the fact that it has just completed partial consolidation of its activities in Winston Salem in a new plant for the manufacture of electronics equipment. Covering 625,000 sq ft, the factory employs 4000 people. Personnel recruitment has offered few problems. Work includes fabrication, apparatus manufacture, and assembly wiring and testing. Most of the work requires considerable dexterity but no great experience, except on electrical testing and the usual skilled trade assignments.

LABOR RELATIONS

There is a curious similarity in the experience of most metalworking plants in North Carolina, regardless of the type of work performed. Most of them report exceptionally low absenteeism rates, and labor turnover rates of only about 15% or less. And despite the lack of experience —or perhaps because of it—accident rates are extremely low. That most employees are actively interested in the well-being of their companies is indicated by the large number of suggestions received by suggestion committees, and their adaptability is proved by the high percentage (over 50% in many cases) of supervisors who have been developed directly from the ranks of locally hired people.

Unionism is not particularly popular, but plants which are unionized report a minimum of trouble and generally have excellent relations with the locals. Community relations are particularly happy, and no cases have been reported in which a community has shown resentment at the construction of a factory within its bounds.

A major factor in the labor-relations picture lies in the fact that many of the new factory workers live on small farms and can supplement their incomes with earnings from their own crops and livestock. This means that they can afford to be considerably more independent than those who must live in crowded tenement districts, and the very fact of their dispersal and their preoccupation with farm matters during their off-work hours makes them particularly difficult to organize. Moreover, the additional income more than offsets any regional wage

SEE AUTOMATION IN ACTION

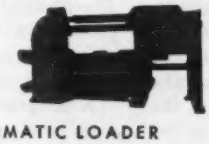
Lo-swing

EXHIBIT

SPACE 1013

NEW LATHES

A NEW DRILLING HEAD



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This trouble happened in a plant using a huge hydraulic surface grinder for rough and precise finishing of parts for home power saws. To obtain precise finishes, table speed had to be reduced; but whenever this was done the table jumped, resulting in poor finish and excessive rejects. To overcome table jumping, the operators *tripled* hydraulic pressure in the machine. This caused failure of tubing and fittings, increased wear, shut down the grinder an average of 10 hours a week!

A Socony Mobil man discovered this trouble while providing engineering service to this plant. After studying the grinder, he recommended using a special Gargoyle oil for table way lubrication. This cured the table sticking and jumping. Hydraulic pressure was reduced to normal. The plant is now saving $8,000 a year on production alone—has cut maintenance costs drastically!

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differential. This does not mean that there are major differences in wage patterns. Indeed, the old myth of "cheap" Southern labor has long since been discarded. But it does mean that a worker has a much greater feeling of security than one who must rely on the factory for his entire income.

NO LABOR SHORTAGE

Perhaps one of the most significant points is that the workers of North Carolina tend to be younger than those in Northern areas. For example, in 1948, 38% of the population of the state was under 18 years old, as compared with 28% in New England and 31% for the entire country. This virtually guarantees a continuing increase in population. Many of these young people, moreover, find agricultural jobs less readily available because of the increased mechanization of farming, and they are thus eager for factory employment. As an example of this, one company recently advertised for workers in an area in which only some 400 workers were listed as unemployed in the 1950 census. It had 4500 applicants for the 550 jobs available; a ratio of almost 9:1.

The reason for this apparent discrepancy lies in that fact that many of these potential workers live on small "subsistence" farms and are thus not technically unemployed, although most of them would be only too glad to accept factory work at nearby plants.

It must be stressed, however, that this new industrialization of the South does not indicate an industry shift such as took place some few years ago in the cotton and silk industries. That wholesale closing of Northern plants brought widespread unemployment and created distress conditions from which some cities have not even yet recovered. This movement, however, is in the nature of an expansion program brought about by the demands for increased production. No Northern workers will be deprived of employment because of it, but it is becoming more and more apparent that the North is approaching a condition of industrial saturation, and that there is no point in constructing new plants there because there is not sufficient labor available to staff them. The South, on the other hand, offers new opportunities for development, adequate labor, and a chance to broaden the whole national industrial picture.

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combined with our other STANDARDIZED COMPONENTS offer LOW COST AUTOMATION on these operations:

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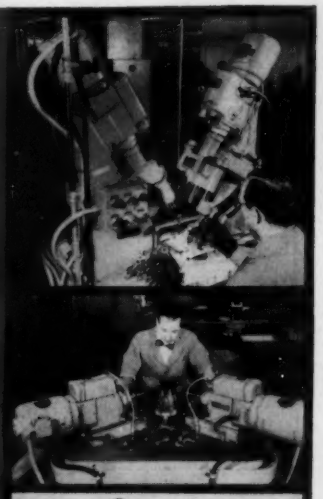
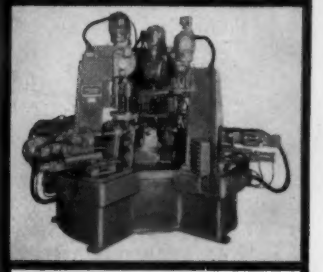
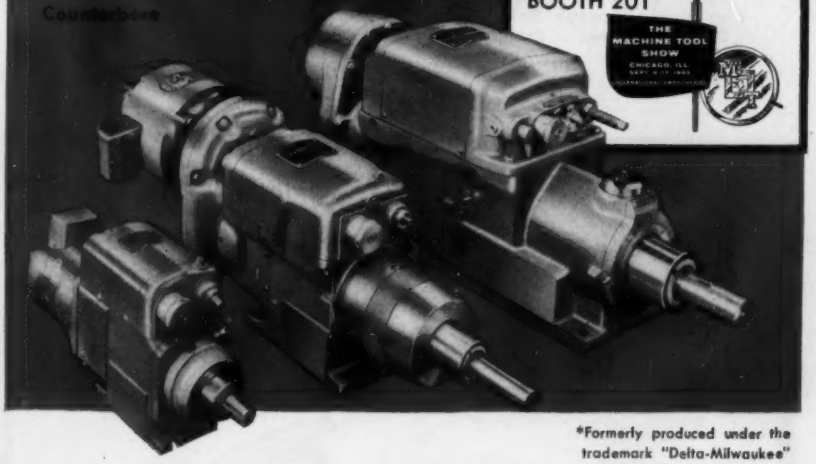
Recess





BOOTH 201

THE MACHINE TOOL SHOW CHICAGO, ILL.



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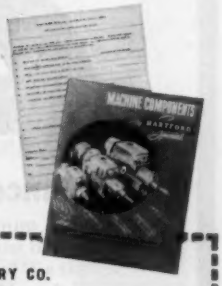
Absolute depth and feed control plus high rapid traverse make "Hartford Special" Drill Units workhorses on high production jobs requiring accurate machining operations. These flexible components can be combined with other Hartford standardized components to provide low cost automation to every manufacturer through machines of his own construction. Our large staff of Sales Engineers is ready to study your processing problems and make recommendations to lower your manufacturing costs.



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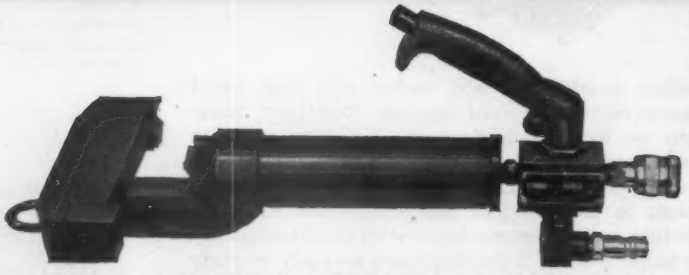

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MACHINES AND ATTACHMENTS

1 VERTICAL ROTARY MILLING MACHINES — *Consolidated Machine Tool Co, Rochester 10, NY.* 40-page illustrated buletin 651 describes Newton Continuous Rotaries. Applications, advantages on short-run work covered; use of automatic self-opening and closing fixtures included.

2 SHEAR-SPEED GEAR SHAPERS—*Michigan Tool Co, Detroit 12, Mich.* 8-page bulletin SS-55 contains illustrated details on additions to line: Models 18136 and 18206 for shaping gears up to 20-in.-dia with 6-in. face width, 2 DP, at high rate production. Machine features, dimensional and operational specifications covered, plus discussion of basic Shear-Speed cutting principle.

3 UTILITY PRESS—*Producto Machine Co, Bridgeport 1, Conn.* 4-page illustrated bulletin TE4-101 covers Model No. 2 which combines features of screw, ram, and power press in one machine. Can also be used with slight modifications for plastic mold work. Contains design and construction features, application data and specifications.

4 POWER PRESSES—*Famco Machine Co, Kenosha, Wis.* 12-page catalog illustrates and describes line of 50 models from 4 to 18 ton, in both bench and floor models. Specifications, die space dimensions, data on press tonnage requirements; available accessories included.

TOOLS AND ACCESSORIES

5 MECHANICAL PRESSURE GAGE —*W C Dillon & Co, Van Nuys, Calif.* 6-page bulletin PG-4 illustrates applications and describes features of new switch model. Details of switch arrangement and ratings provided; dimensions and price schedules included.

6 THROW-AWAY CARBIDE INSERTS—*Viking Tool Co, Shelton, Conn.* 6-page bulletin 55 contains data on six sizes and eleven styles of Dexamatic "Chiptrol" tooling for light and medium-duty machining applications with triangular and square inserts, with negative as well as positive rake angles. Carbide grade selector guide included.

7 CHUCKS—*O S Walker, Worcester, Mass.* General catalog covers rectangular, swivelling, rotary, and magnetic chucks, vacuum chucks, special types, demagnetizers, planer parallels, and new line of lifting magnets.

8 MAGNETIC DATA STORAGE DEVICE—*Brush Electronics Co, Cleveland 14, Ohio.* Folder describes TapeDrum, a combination magnetic drum and tape recorder for inventory control, data reduction, trend recording, and table storage.

9 BALANCED ACTION GAGES — *Winter Brothers Co, Rochester, Mich.* 33-page illustrated catalog No. 2 covers threaded and cylindrical plug and ring gages with current net prices on all stock items. Dimensions and standards included.

10 PRECISION BORING & FACING HEADS—*Maxwell Co, Bedford, Ohio.* 6-page catalog gives illustrated information on E-Z Set units. Features described; dimensional charts included.

11 GAGES—*Sossner Tap & Tool Corp, Lynbrook, NY.* Combination file folder and brochure describes and illustrates line of Taperlock, Trilock and wire type cylindrical plug gages and thread plug

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a challenge to the rated capacity of your present hand turret lathes!

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1. output
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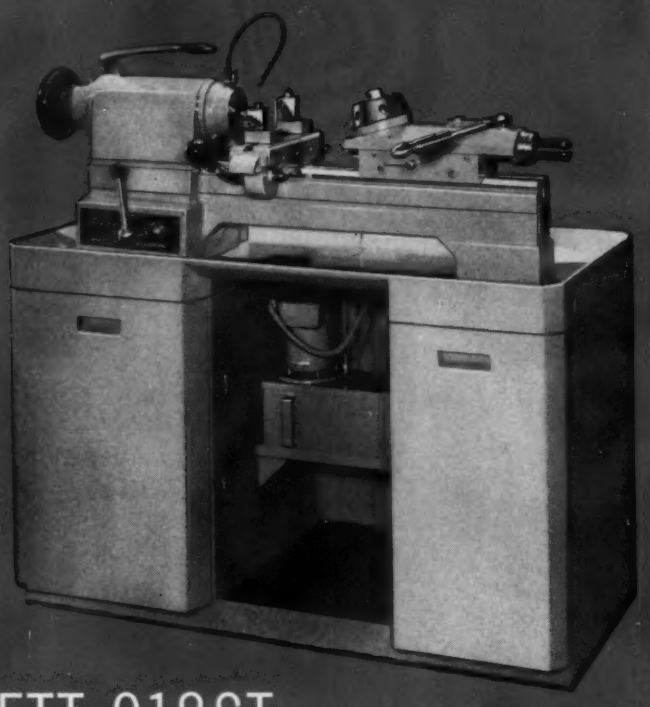
3. set-up time
4. rejects



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HEAT TREATING AND WELDING

12 SINTERING FURNACES — *Drever Co, Bethayres, Pa.* 12-page bulletin B-101 provides illustrated data on units for sintering powder metal products, and reduction of metallic oxides. Variety of types and sizes described.

13 WELDING HEAD — *Raytheon Mfg Co, Waltham 54, Mass.* Data Sheet PD 2-201 describes Model J precision welding unit for small parts and subassemblies. Design and operational features illustrated.

14 PLATING TANK TEMP CONTROL — *Minneapolis-Honeywell Regulator Co, Philadelphia 44, Pa.* 9-page illustrated Data Sheet 5.1-4 describes application of Honeywell instrumentation to various types of plating tanks. Diagrams of typical installations cover use of electric and pneumatic temp control systems, and of recording, indicating, and non-indicating instruments.

15 SPOT WELDER—*Sciaky Bros, Inc, Chicago, Ill.* 8-page bulletin 334-3 contains illustrated information on Type PMCO 2 ST air-operated press type, 3-phase, Modu-Wave unit for resistance welding to rigid aircraft and government specifications. Operation principles and design advantages outlined. Charts, and tabular data included.

16 TEMPERATURE BRIDGES—*Leeds & Northrup Co, Philadelphia 44, Pa.* 2-page illustrated data sheet E-33 (2) gives information on bench-type and portable DC bridges for temp and temp difference measurements of moderate accuracy by resistance thermometer method. Construction, circuit diagrams, specifications and accessory equipment included.

17 PLANNING A HEAT-TREATING DEPARTMENT—*Lindberg Engineering Co, Furnace Div, Chicago 12, Ill.* 24-page booklet describes proper furnace-size selection; shows recommended layouts; gives approximate floor-space requirements; lists auxiliary equipment, such as tongs, straightening presses, workbenches, hardness testers, etc.

18 CONTROL FOR ARC-WELDING MACHINES — *Worthington Corp, Worthington-Mullenbach Controls Div, Harrison, NJ.* 4-page illustrated bulletin R-1700-B17 gives information on "Arctrol," a portable remote control for adjusting amperage on all makes of arc-welders. Details on operation, construction, installation, advantages. Application data in chart form for various makes of welders; component parts pictured; parts and price list included.

PLANT SERVICE EQUIPMENT

19 TROLLEYS FOR OVERHEAD CONVEYORS—*Link-Belt Co, Chicago 1, Ill.* 20-page illustrated Book 2536 describes ball-bearing trolleys. Dimension and application data, attachments, selection information included.

20 LIQUID BLAST CLEANING—*Pangborn Corp, Hagerstown, Md.* 8-page bulletin 1403 contains photographs, dimensions, sizes and features of all models of the EZ-2 and EZ-3 Hydro-Finish machines for deburring, surface finishing and preparation.

21 SAFETY SERVICE GUIDE — *National Safety Council, Chicago 11, Ill.* 68-page Guide 2.1 is an illustrated catalog of varied accident-prevention aids available. List of Council periodicals, complete library of technical and administrative publications covering all phases of occupational accident prevention.

22 STORAGE SYSTEMS—*Paltier Corp, Michigan City, Ind.* 4-page illustrated bulletin on Paltier engineered systems for

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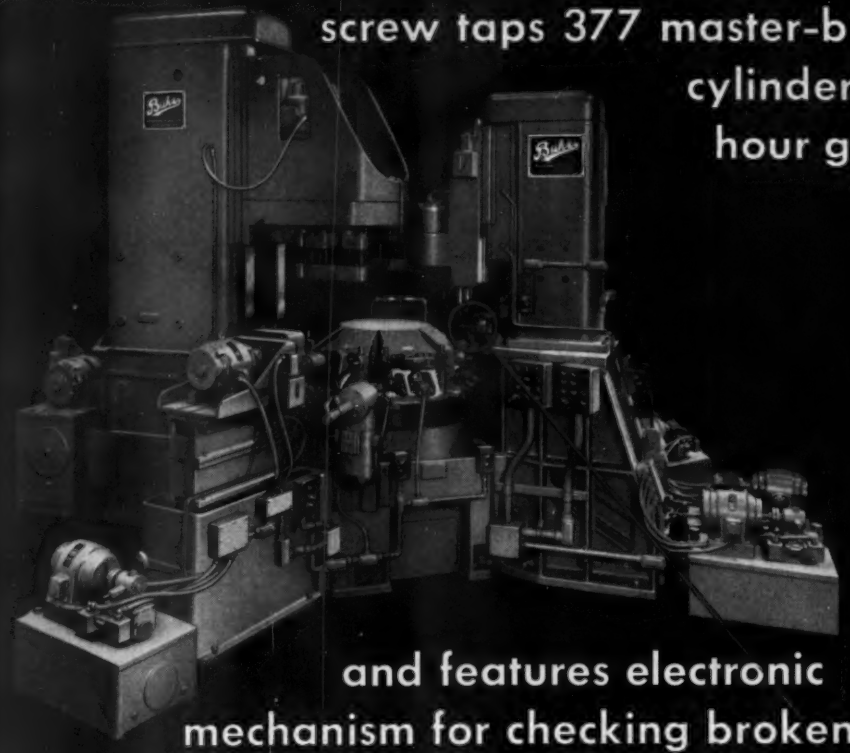
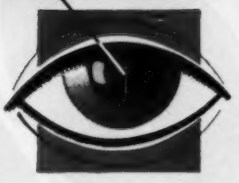


and features electronic mechanism for checking broken drills!

This 7-way dial-type hydraulic-feed Buhr Special has a 48"-diameter 7-position power-operated index table, complete with shot bolt. Two parts are loaded per station in each of its seven fixtures. Automatic clamping of fixtures is performed by a power-wrench with torque control.



Electronic mechanism automatically checks two .028 drills. Following each cycle, drill-checking arms swing sensing probes to and from drills. If either drill is broken, special electronic sensing-circuit stops machine and flashes failure-light.

Buhr
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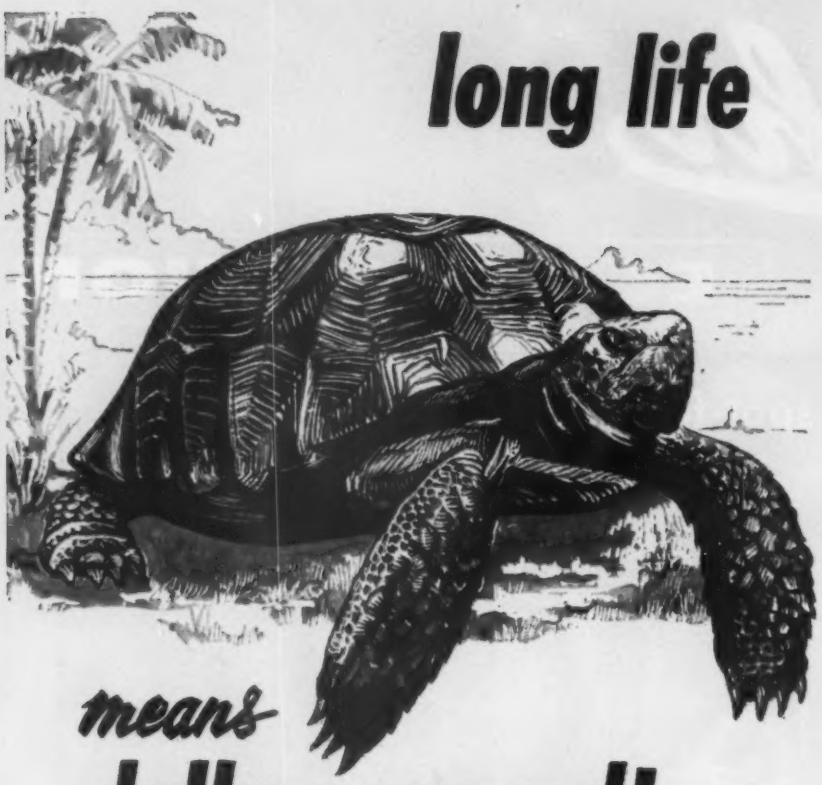

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23 ULTRASONIC CLEANING EQUIPMENT — *Acoustica Associates, Inc, New York 1, NY.* Bulletin DR-400 describes Model DR-400 unit for production cleaning and degreasing, electroplating, soldering aluminum, degassing molten aluminum, metal cutting, and other applications. Contains operational principles; specifications included.

24 HAND LIFT TRUCKS — *Barrett-Cravens Co, Northbrook, Ill.* 6-page bulletin 555-1 contains illustrated information on single stroke units. Specifications, features, operating views, specific applications covered.

25 FINGERPRINT REMOVER — *E F Houghton & Co, Philadelphia 33, Pa.* 4-page illustrated bulletin describes Cosmoline 1070 for protection of highly polished or super-finished surfaces from corrosion caused by fingerprints. Particularly applicable to non-ferrous metals and bi-metallic assemblies.

26 FLAT STEEL STRAPPING EQUIPMENT—*Gerrard Steel Strapping Div, US Steel Corp, Chicago 32, Ill.* 8-page illustrated brochure describes line of heavy-duty equipment and accessories for loading, palletizing, and unit reinforcement.

27 AUTOMATIC PACKAGING MACHINE—*Product Packaging Engineering, Culver City, Calif.* 4-page illustrated brochure contains descriptive data on the Pak-O-Mat. Feeds gaskets, nuts, O-rings, bolts, bearings, valves, etc, from hopper down vibratory chute onto moving strip of sealing material. Prints, seals, packages, cuts off automatically.

28 CONVEYOR EQUIPMENT — *Prab Conveyors, Inc, St Clair Shores, Mich.* 40-page catalog 400 illustrates and describes line, including Magnavator, Tube-Veyor, Chip-A-Way, and custom-built equipment.

29 HYDRAULIC CRANE — *Austin-Western Co, Aurora, Ill.* 8-page brochure contains dimensions and illustrated applications. Performance data, attachments, special equipment described.

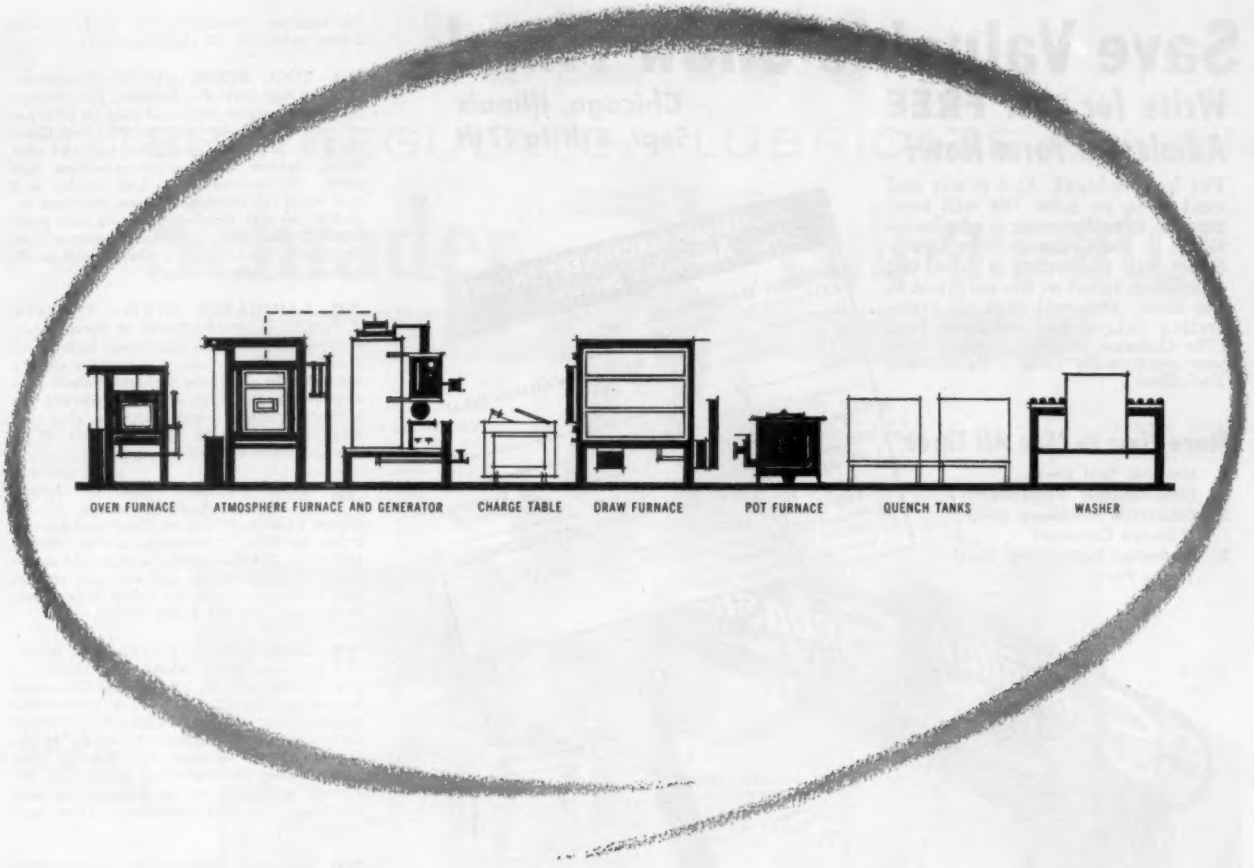
30 STEEL BELT CONVEYORS — *Sandvik Steel Belt Conveyors, Division of Sandvik Steel, Inc, Fair Lawn, NJ.* 48-page illustrated, hard-cover book gives engineering and application data. Describes basic features, provides details on characteristics, capacities, adaptations, and design. Load capacities of various widths of belt as applied to specific types of materials are indicated.

PARTS AND MATERIALS

31 NEEDLE BEARINGS — *Torrington Co, Torrington, Conn.* 76-page illustrated catalog 55 contains engineering data on design, application, and operation for five types of bearings. Selection information on size, type, suitability, characteristics; dimensions, recommended shaft diameters, housing bores, and rated load capacities included.

32 GEARS—*Sier-Bath Gear & Pump Co, North Bergen, NJ.* 44-page illustrated "Gears of Integrity" illustrates principal types of gears and miscellaneous combinations; describes most modern methods and techniques of gear testing for extreme accuracies, and explains newest trends in gearometry. Engineering graphs and tables; pitch and accuracy requirements for various velocities; checks for strength, accompanied by reference scales and graphs.

33 CONTROL VALVES — *Versa Products Co, Brooklyn, NY.* 8-page catalog covers 40,000 hydraulic and pneumatic units. Six sizes are illustrated with actuat-



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ing devices. Dimensions for 5, 4, 3, and 2-way valves in all sizes included.

34 TOOL STEEL GUIDE—*Vanadium-Alloys Steel Co, Latrobe, Pa.* 70-page brochure contains technical data on 50 types of tool steels and cold finished products. Data on HSS, die steels for hot and cold work, carbon and carbon-vanadium tool steels, chrome-vanadium tool steels, and tool steels for special purposes. Sections included on cold finished products and powdered metal heat treatment, composition, hardness-after-tempering charts, and applications for each type.

35 LAMINATED STEEL FLEXPIN COUPLINGS—*Smith & Serrell, Inc, Newark, NJ.* 4-page illustrated bulletin 53 specifies where to use, and how to specify couplings to eliminate accidental shaft misalignments and load shocks. Ordering information, dimensional drawings, plus tabular data indicating characteristics of 21 sizes of units available.

36 BASIC STEEL PRODUCTS—*Joseph T Ryerson & Son, Chicago 80, Ill.* 4-page bulletin 11-2 is an illustrated buyers' guide to bars, structurals, plates, sheets, and strip. Provides data on standard specifications, type, range, and accuracy of cutting to needs; covers hot rolled carbon bar, structural, and flat rolled steels.

37 HEAVY METAL — *Fansteel Metallurgical Corp, Metals & Fabrication Div, North Chicago, Ill.* 20-page illustrated booklet covers Fansteel 77, a machinable tungsten-copper-nickel alloy used where high density is required in small space; twice as heavy as steel, 50% heavier than lead. Booklet lists physical properties, describes processes of manufacturing and finishing, contains reference tables and charts.

38 SPIROID GEARS — *Illinois Tool Works, Chicago 39, Ill.* 15-page booklet illustrates and describes gears for medium to high reduction ratios. Includes relation to other gears, performance data, advantages, tabular data on mounting tolerances and backlash control.

39 STEELS — *Allegheny Ludlum Steel Corp, Pittsburgh 22, Pa.* 16-page 5th edition of complete publication list covers company's 85 current technical data sheets and booklets. Includes stainless, electrical, tool, and die steels, and other high alloy specialties.

40 LUBRICATED PLUG VALVES—*Homestead Valve Mfg Co, Coraopolis, Pa.* Illustrated, 28-page Reference Book 39-5 shows straight-way, 3-way, 4-way, and multiple port lubricated units for 250-lb oil-water-gas, and 150-lb steam working pressure. Describes wide choice of metals and sizes in 100% pipe area and venturi types.

41 "HOW ZINC CONTROLS CORROSION" — *American Zinc Institute, New York 17, NY.* 32-page illustrated booklet describes many ways in which zinc lengthens life of steel products, reduces maintenance costs. Drawings, charts, etc, analyze corrosion-control characteristics of coatings, pigments, and anodes. Applications presented.

42 TITANIUM ALLOY—*Mallory-Sharon Titanium Corp, Niles, Ohio.* 4-page bulletin describes MST 6A1-4V; lists metallurgy and chemistry, properties, recommended heat treatment, forging, welding procedures. Alloy can be used at temps up to 750 F with minimum creep or change of properties. Said to have excellent strength and stability, insenstitive to notches; can be hot-worked over wide range.

43 POWER MOTOR-GEAR-TRAIN — *John Oster Mfg Co, Racine, Wis.* Catalog sheet illustrates and describes unit. Technical information includes dimensional drawings, performance features, and tabu-

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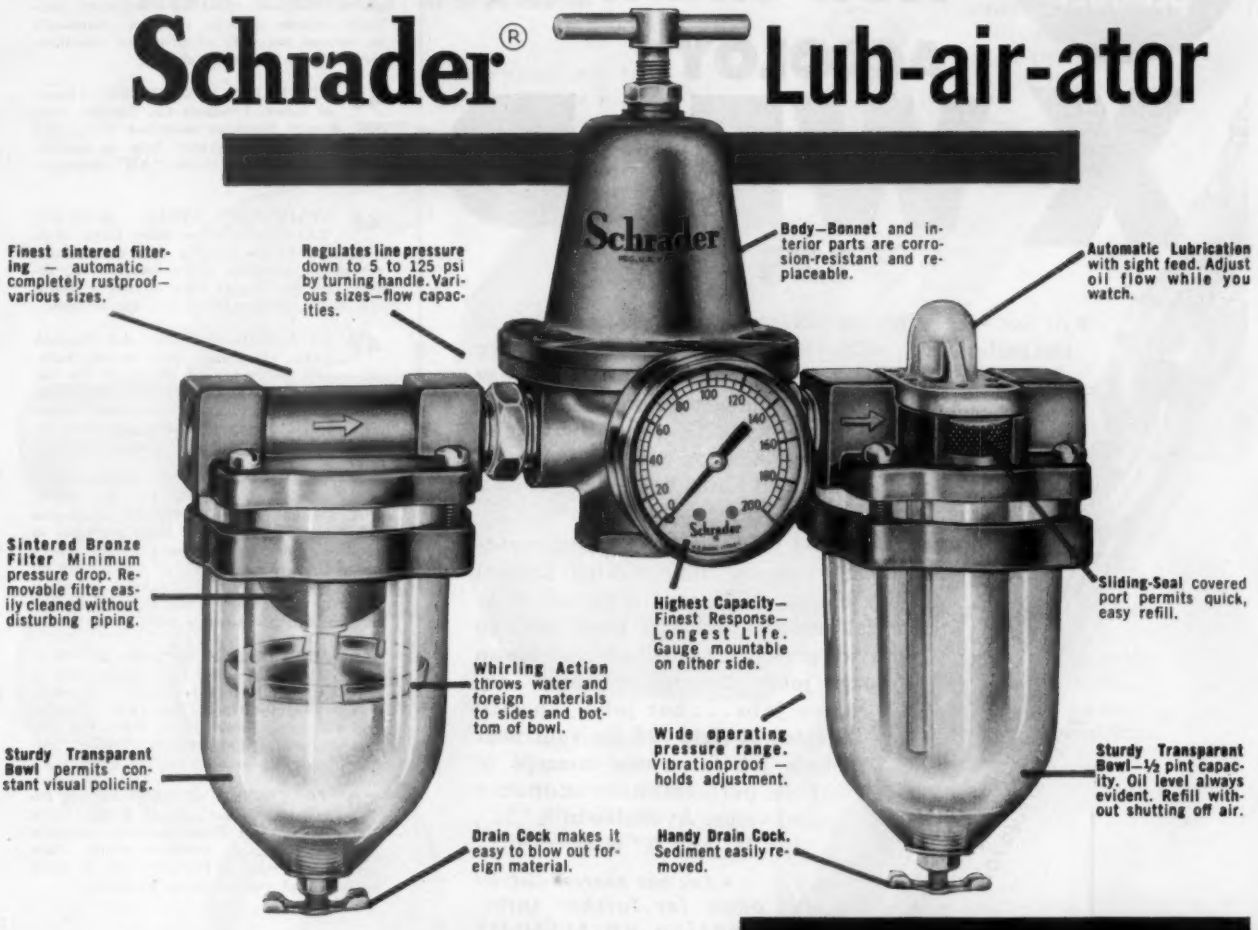
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lar data on motor length, gear train length, etc.

44 PLASTIC PRODUCTS — *American Agile Corp, Bedford, Ohio.* 48-page catalog illustrates and describes complete line of polyethylene and polyvinyl chloride fabricated products, including plates, sheets, rods, tubes, pipes, and fittings, plus hot gas welding and spraying equipment. Sections include data on chemical resistance to various reagents of products, specification details, reference charts.

45 STAINLESS FASTENERS—*Allmetal Screw Products Co, Garden City, NY.* 8-page brochure describes styles and sizes in stock. Illustrated data on screws, bolts, nuts, washers, rivets, "AN" fasteners, nails, pins, etc.

46 STAINLESS STEEL GLOBE VALVES—*Cooper Alloy Corp, Hillside, NJ.* 4-page catalog 55A covers line; schematic drawings of various models, design factors; tabular data on major stainless alloys, designations, and applications.

47 SOLENOID VALVES—*A-P Controls Corp, Milwaukee, Wis.* 6-page bulletin covers entire range designed for use with liquids, gases, or refrigerants; can be used for stop and start operations. Selection data, features, typical applications included.

48 VARI-PITCH SPEED CHANGER—*Allis-Chalmers Mfg Co, Milwaukee, Wis.* 6-page bulletin 20B6013D illustrates operating advantages of units available in 12 sizes from 1 to 75 hp with output speeds up to 2900 rpm. Operate in either vertical or horizontal position. Includes selection table for recommended unit size of standard motors, and speed range table.

49 ADJUSTABLE SPEED DRIVE — *General Electric Co, Schenectady 5, NY.* 8-page illustrated bulletin GEA-6234 covers general-purpose, full-wave, Thy-motrol adjustable speed drive. Featuring several industrial applications, booklet emphasizes unit's printed control circuits.

50 POLYESTER RESINS—*Barrett Division, Allied Chemical & Dye Corp, New York 6, NY.* Folder contains complete technical data on Plaskon resins. Data covers properties of Barrett's line of rigid, flexible, and resilient-type products.

New Books

BASIC LUBRICATION PRACTICE—*By Allen F Brewer. Published by Reinhold Publishing Co, 430 Park Ave, New York 22. 286 pages, 6 x 9 in. Price, $6.75.*

As its title implies, this book is devoted to a study of the practice of lubrication, rather than the principles involved, and it does very well at it. All the basic problems and types of lubrication encountered are discussed, with recommendations for best results.

Included with the normal subject matter dealing with bearings, motors, and the like, are chapters on chains, wire rope, flexible couplings, air compressors and pneumatic tools, storage and handling, and a brief description of the newer synthetic lubricants.

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with charts, photographs, and sketches, and is recommended for anyone who needs to get a quick understanding of standard lubrication practice. Although there is some basic design information, such as dimensions of oil grooves, life expectancy of bearings, and so on, this book is not especially likely to be of use to the advanced lubrication engineer, who ought to know its contents pretty well already.

IDR REPRINT SERVICE. *Published by Industrial Diamond Review Information Bureau, 32-34 Holborn Viaduct, London E C 1, England. 12 pages 7¼ x 9¾. No charge.*

This latest edition contains references to over 200 reprints of articles published in *Industrial Diamond Review* and contemporary journals. Most of these are in English, but there are a few in French and German. The titles are classified into main groups covering the various scientific and industrial fields of application of diamonds. An author index is also given.

JUSTIFYING THE PERSONNEL PROGRAM —*No. 160 in the Personnel Series of the American Management Association, 330 W 42nd St, New York 36. 52 pages, 6 x 9 in. Price, $1.75, non-members; $1.00, members.*

"Justifying" a staff job can be one of the most difficult problems a person can face, in the era of tightening cost controls. This book points out several ways in which you can prove to your cost-conscious management that the work you are doing is productive, even though you can't always measure the dollar value of your contribution.

Areas covered include a general discussion of how the personnel department can "sell" its services, means of measuring attitude responses to personnel programs and policies, controlling costs of the personnel department, and a very stimulating description of an organized approach to cost reduction.

Because it remains somewhat general in approach, the book does not quite live up to its title, leaving much to be said about the problem of proving the usefulness of the staff job. However, the fault lies more with the title than the book, for the subject matter is interesting and well presented, and discusses problems which would arise whether or not the problem of self-justification were present.

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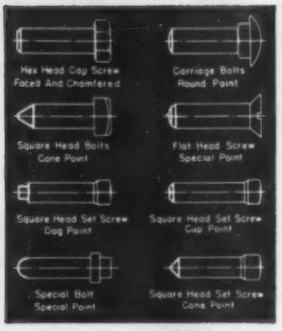
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Square Head Bolts Cone Point
Flat Head Screw Special Point
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Square Head Set Screw Cup Point
Special Bolt Special Point
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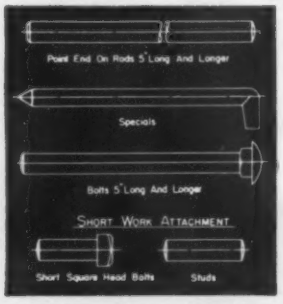
Typical parts machined on the TYPE 4600



Typical operations performed on TYPE "P" Semi-Automatic Pointing Machines

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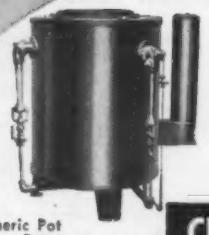

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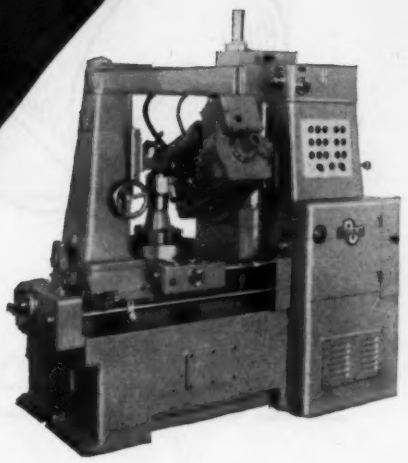

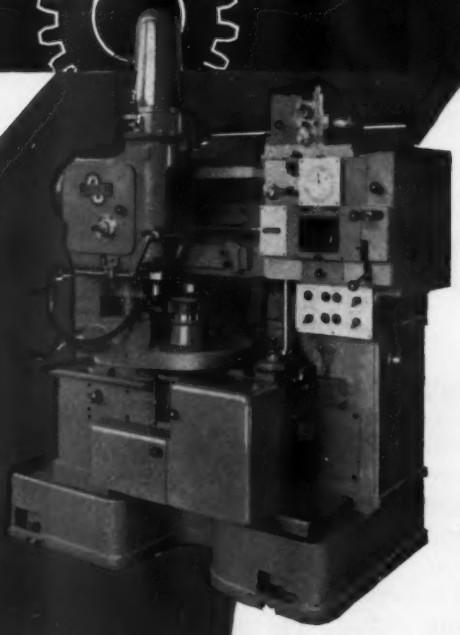

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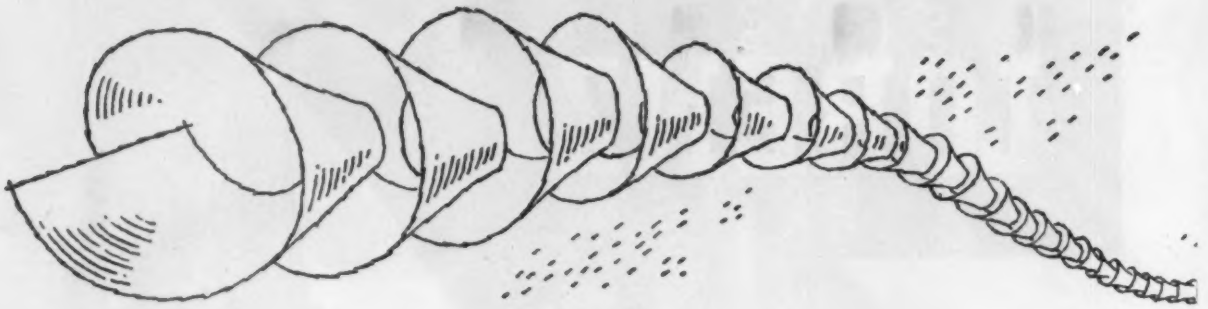

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Burnham Finney's typewriter is the only thing that applies the brakes to his almost constant travel schedule. Fortunately, it applies the brakes often enough to make sure a great and growing industry gets his exclusive, first-hand reports on important developments every other week.

Burnham Finney has been "on the go" ever since, fresh out of the University of Cincinnati, he spurned a law-school scholarship to open his own industrial news bureau, supplying about twenty business magazines and newspapers with the latest news of Midwest industry.

Thirty years and a million travel miles later, this indefatigable editor is still out of his office much more than he is in it. He maintains personal contact with hundreds of top metalworking executives coast to coast. His exclusive reports on the Washington scene as it affects Metalworking are the result of *being there* when the news is in the making. He has recently renewed again the European contacts he so soundly established when, at the request of the British Ministry of Production, he gave our World War II allies his on-the-spot help in boosting armament production to record levels.

And now, as it has been doing ever since Burnham Finney became Editor of ***American Machinist*** in 1938, his typewriter continues to record a notable succession of reporting "firsts" in a basic industry.

First vocal exponent of automation's great future, constant champion of the pressing need for modernization in Metalworking's sprawling production shops, writer of prize-winning editorials, confidant of his industry's top executives and of government's policy makers, Burnham Finney studies the present tirelessly so that his typewriter can brilliantly forecast the future for his magazine's readers.

In experience . . . in knowledge of his job . . . in ability to serve his readers, Mr. Finney is typical of McGraw-Hill editors. They're specialists. They know their fields. They live with the problems of the men—within these fields—who look to them for accurate reporting of news that is vital to their industry.

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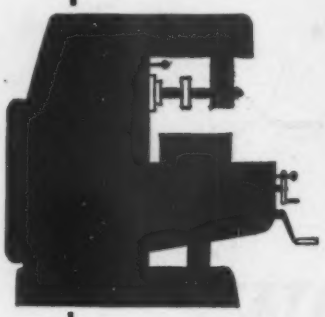

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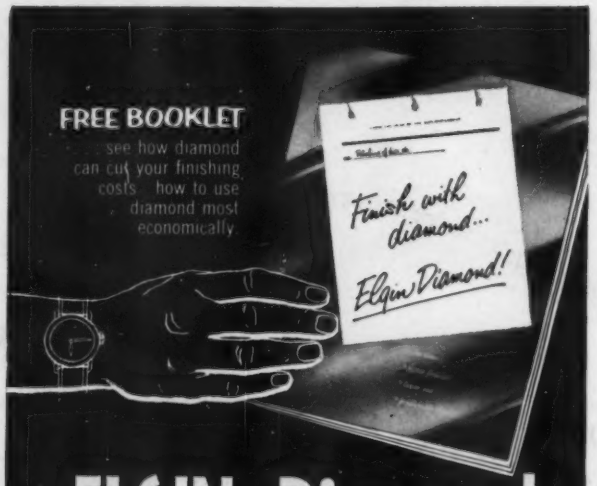

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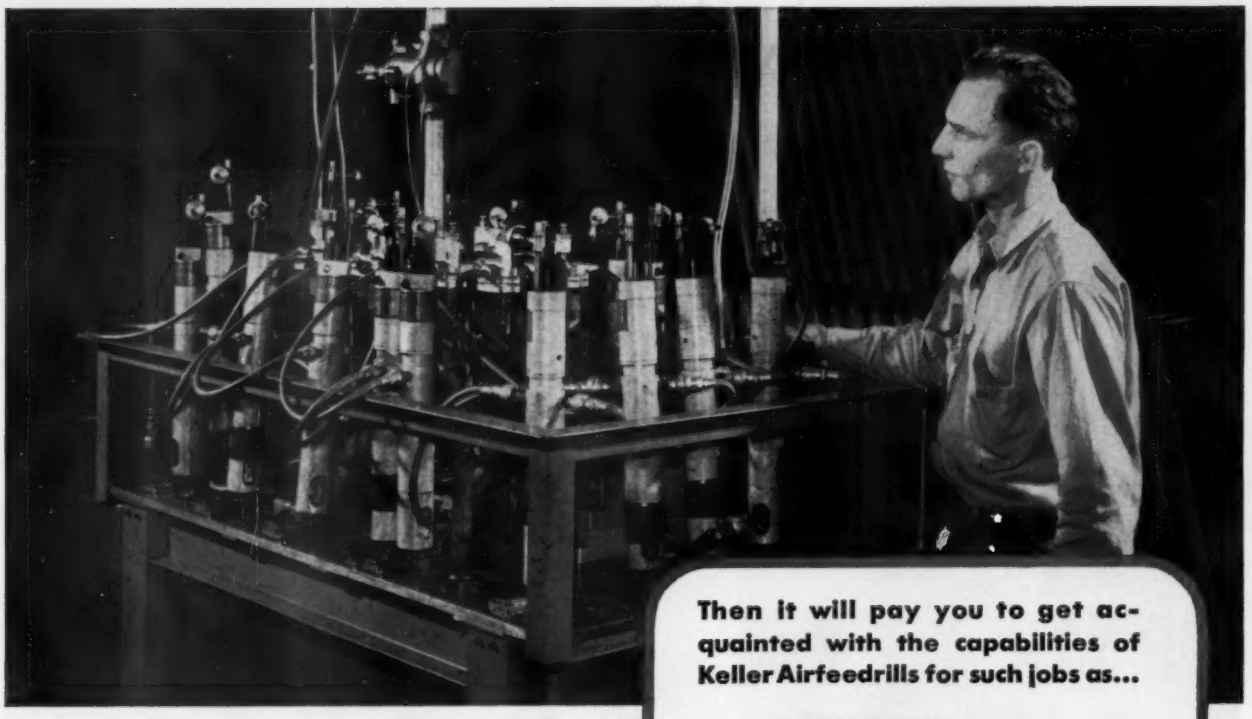

A typical automatic production setup using 14 Keller Airfeedrills. Pressing a single control valve drills 14 holes simultaneously in a refrigerator outer shell assembly—the drills advance, drill, retract, and shut off automatically.

Then it will pay you to get acquainted with the capabilities of Keller Airfeedrills for such jobs as...

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■ These remarkable tools work without supervision, and take the place of expensive machines in automation setups. They are entirely air controlled and operated, automatically cycled, and extremely accurate.

■ Among the special advantages available are sensing type rapid advance, hydraulic feed control, and adjustable torque control. Thus they are able to do peck drilling, skip drilling, and other jobs that heretofore have required expensive machine tools.

■ Write and tell us about your machining problems. We will send appropriate bulletins or have a representative call to discuss Keller Air Tools.

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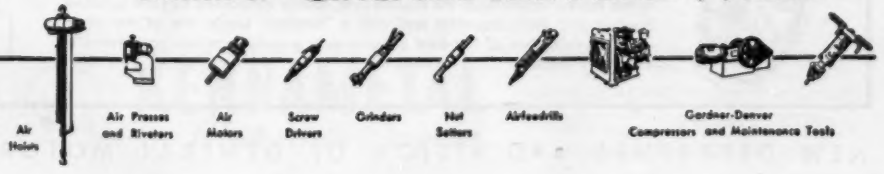
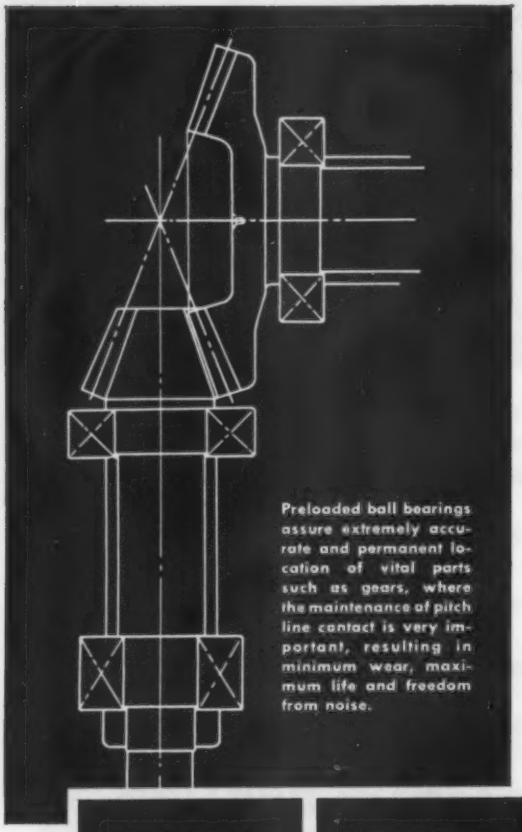


FACTS

about

NEW DEPARTURE
BALL BEARINGS



Preloaded ball bearings assure extremely accurate and permanent location of vital parts such as gears, where the maintenance of pitch line contact is very important, resulting in minimum wear, maximum life and freedom from noise.

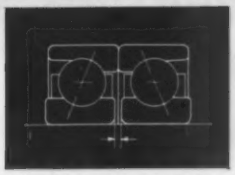
How Preloading Pays Off in Accuracy!

New Departure pioneered preloading to give you a new measure of machine accuracy! This accuracy, due to increased bearing rigidity, pays off in high-precision machines, where the slightest deflection caused by work loads on moving parts can be crucial to the ultimate performance of the machine.

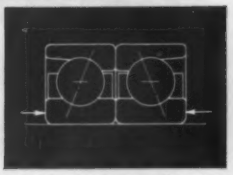
By placing a predetermined internal load on the bearing, either at the time of manufacture or at installation, deflection due to the work load is greatly reduced. This means not only that machine accuracy is greatly improved, but that the ball bearing characteristics of low torque operation and long life are fully retained.

If you are seeking a solution to your bearing problem, call on New Departure for the answer. You will benefit from more than 50 years' experience in bearing design, testing and manufacture.

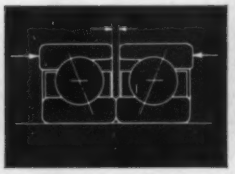
Send for Booklet BA-7 on ball bearing application



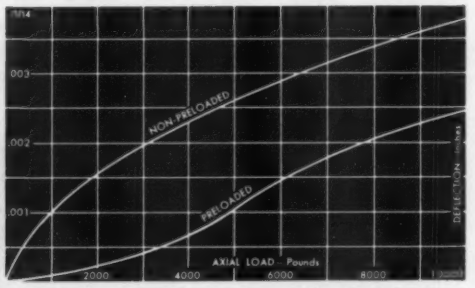
Preload is predetermined, then accurately obtained by grinding Duplex bearing faces so that an exact and fixed compression will take place when mounted.



A Duplex bearing, in effect, becomes a preloaded double-row bearing capable of holding parts within close limits, both radially and axially.



Duplex bearings may be mounted in several different ways to suit load conditions. In each case, extra rigidity of shaft centering is obtained by preloading.

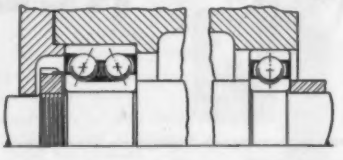


The benefits of preloading can be seen from this deflection curve. The double-row ball bearing referred to here is the most rigid type of unit bearing made to resist loads from any direction.

Typical Application of New Departure Preloaded Ball Bearings

The extreme resistance to deflection and the freedom from wear offered by the New Departure double-row bearing make it a favorite wherever exact location of parts under combined loads must be assured not only initially, but throughout long usage.

In this typical application the double row, solidly supported against suitable housing and shaft shoulders and with a "floated" single row at the other end, provides one of the best general-duty mountings where considerable thrust is present.



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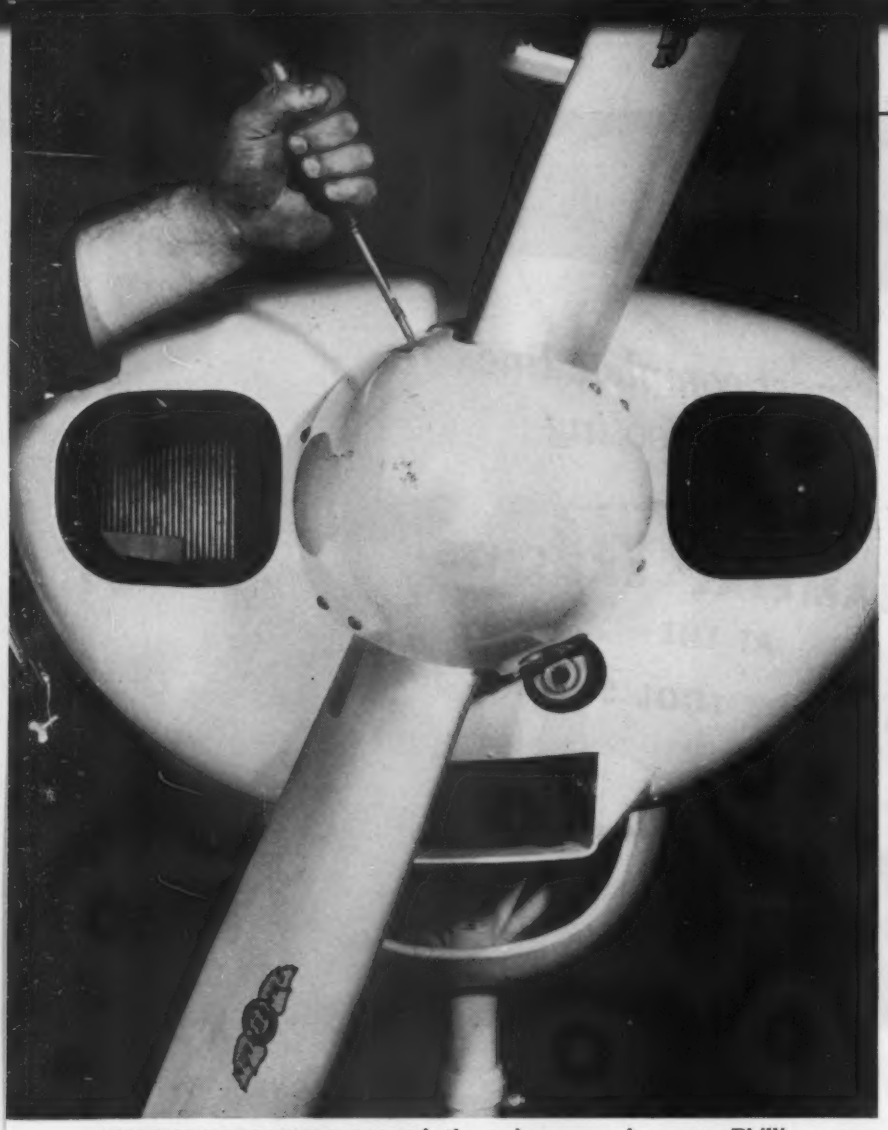

"PROTECTION AGAINST SLIPPAGE is the main reason why we use Phillips screws at Piper Aircraft," says the methods engineer. A slip of the driver in this photo could cause the spinner to be taken off and repainted. But there is no fear of slippage because Phillips drivers securely seat themselves.

"SWIFTER ASSEMBLY, more contact and driving power with Phillips screws have enabled us to use production methods which were impossible with other type screws," says the general manager of Tracy Kitchens. Shown here is a closeup of 6-32 x ⅜" Phillips flat head screws securing the door of an under-sink cabinet.

MANUFACTURERS OF PHILLIPS CROSS-RECESSED-HEAD SCREWS

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X marks the spot
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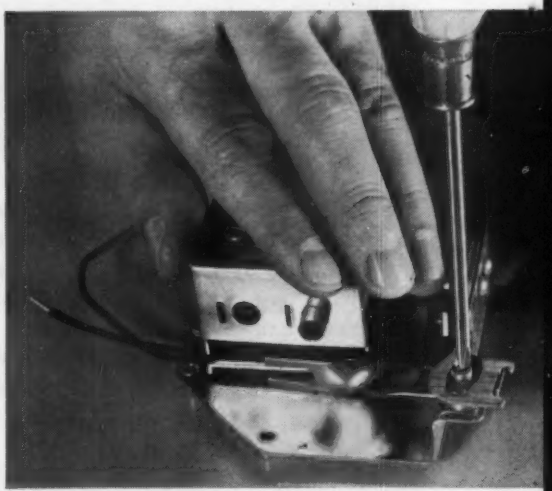
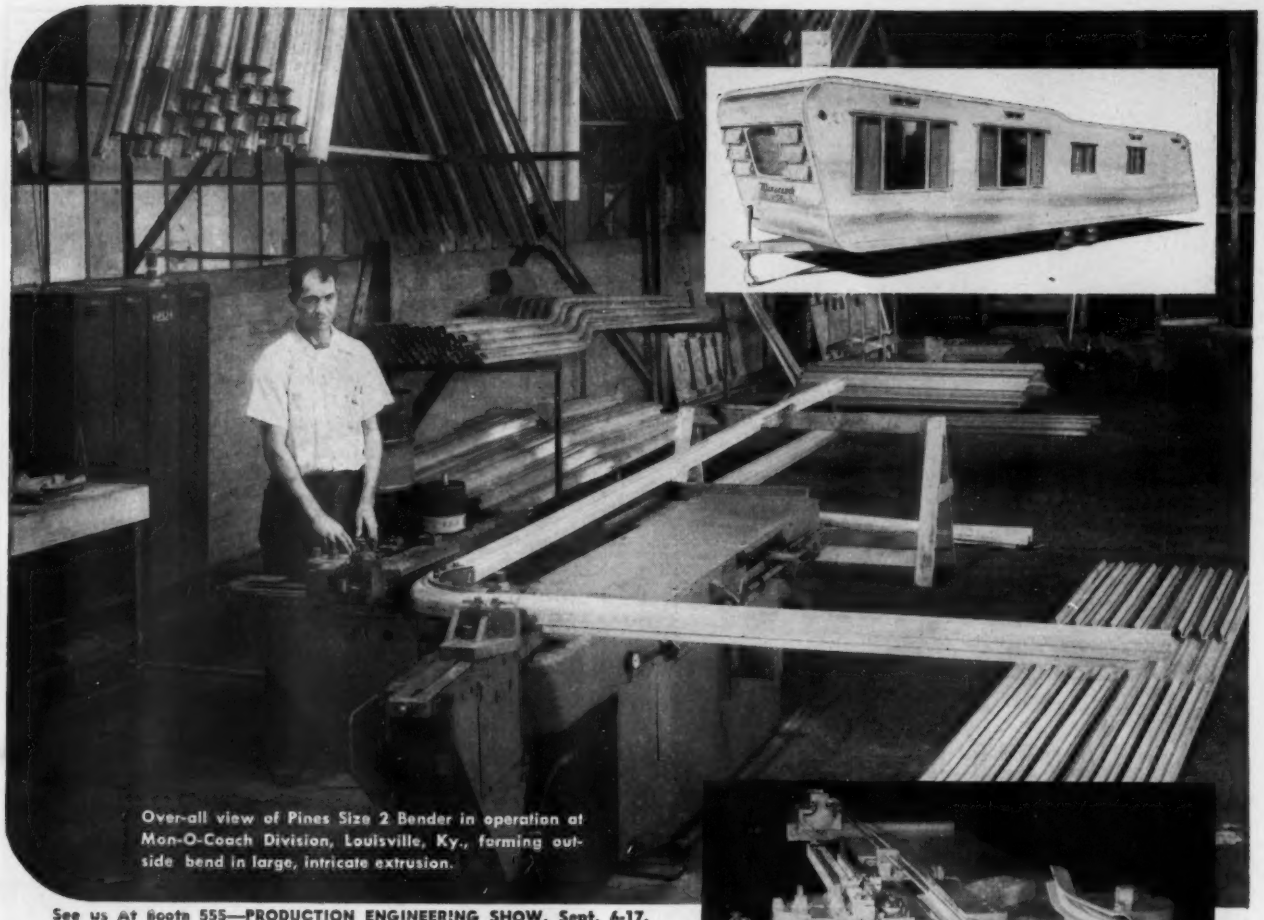


"A BETTER LOOKING FIXTURE is obtained by the use of Phillips cross-recessed-head screws on our 8-Tone chime," says the chime engineer of Nutone Incorporated of Cincinnati, Ohio. "If screws must be used on the exterior of any unit, I definitely feel Phillips recessed head screws are the very best choice."



Over-all view of Pines Size 2 Bender in operation at Mon-O-Coach Division, Louisville, Ky., forming outside bend in large, intricate extrusion.

See us At Booth 555—PRODUCTION ENGINEERING SHOW, Sept. 6-17.

PRODUCTION BENDING ALUMINUM EXTRUSIONS THE "PINES-WAY"

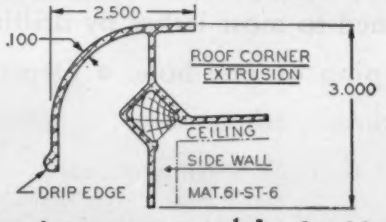
The new, luxurious Mon-O-Coach Mobile Home, manufactured by Mon-O-Coach Division, Ironwood Trailer Coaches, Inc., Louisville, Ky., is a marvel in modern metals engineering. It features all-aluminum structural members which are now cold formed and shaped accurately by production bending methods. Previously, many of the bends were formed by slitting and hand-bending a section, then re-joining the slotted section by welding. Today, a Pines Size 2 Production Bender handles these jobs fast and efficiently.

Slitting and Welding Operations Eliminated

All curved sections are now cold formed in a single operation, including an offset bend in an opposite plane in one of the most ingenious extrusions probably ever developed for the automotive industry. Shown in drawing, this large unique extrusion, incorporating a 5/8" wood section, is a top corner section which serves as a means of fastening top, sides, and front panel members together. Tooling by Pines forms neat, smooth bends without excessive distortion or wrinkling, completing the piece with the wood section in place. Previous slitting and welding operations are eliminated.

▲ View of tooling for making offset bend in opposite direction. Two plug-type mandrels support inner walls. Smooth, neat bends are formed at a bending arm speed of 6.0 r.p.m.

▼ Cross-section of Mon-O-Coach's intricate, top corner extrusion. Hollow center incorporates 5/8" wood section installed before bending—serves as a means for fastening wall studdings.



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If you would like more data on production bending of aluminum extrusions the "Pines-Way", write for free copies of "Pines News". Or ask for a Pines engineer to call and assist you with any production problem.

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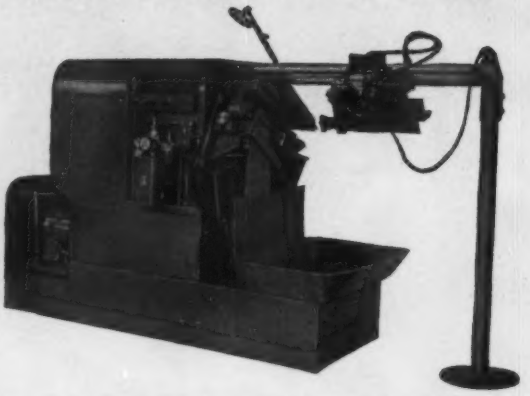

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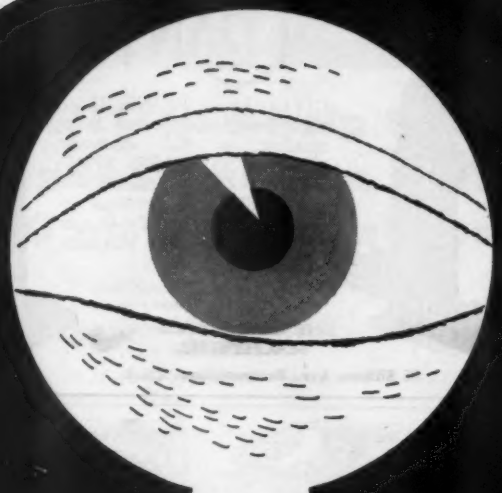

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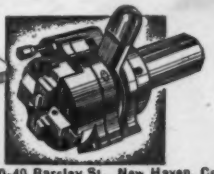

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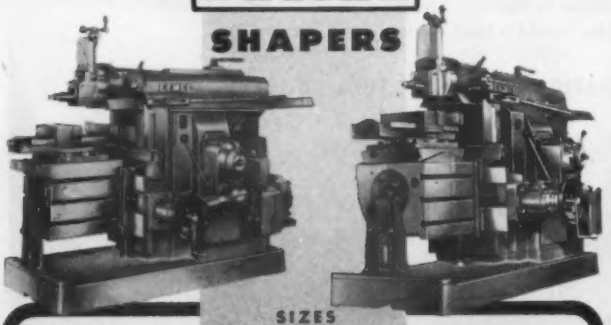

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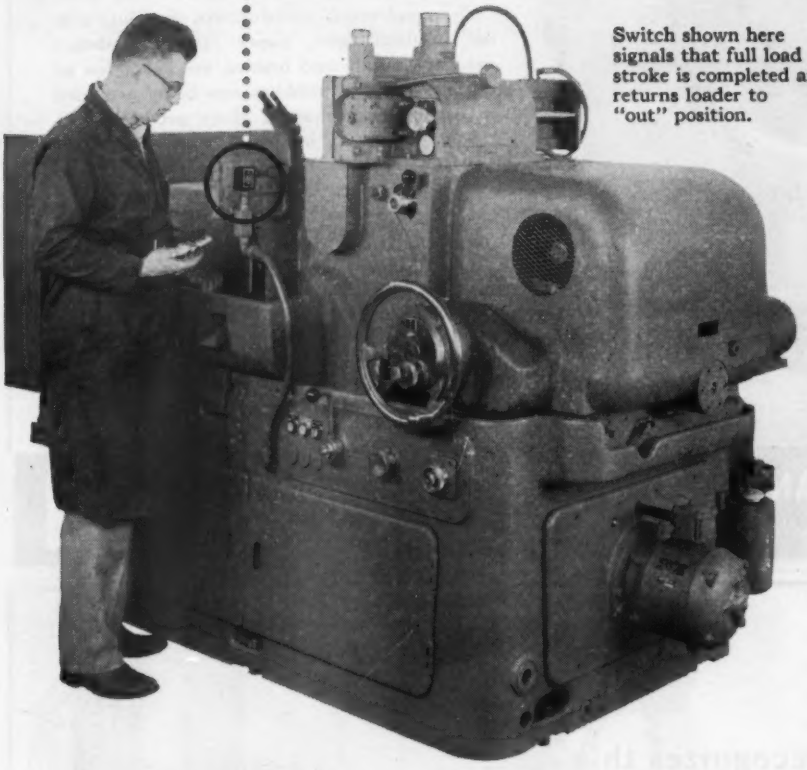
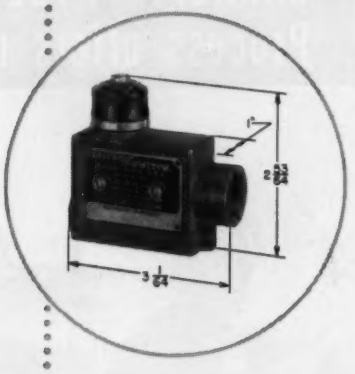
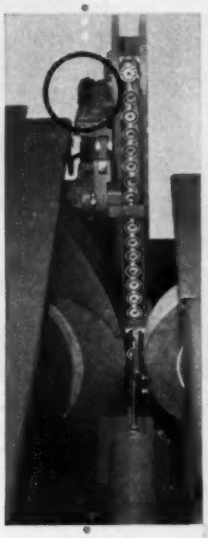
3 SWITCHES help this Landis Grinder precision grind 380 piston assemblies an hour





Switch shown here signals that full load stroke is completed and returns loader to "out" position.



This switch signals that the loader has withdrawn and starts grinding wheel head into position.

Switch signals that finished part has been ejected and starts loader on "load" stroke.

MICRO SWITCH products were selected by engineers of the Landis Tool Company to perform important automatic functions of this No. 12 Centerless Grinding Machine.

The switches signal and control the various steps of the loading and unloading cycle. Landis engineers selected the dependable MICRO SWITCH precision units for this rugged day-in, day-out service because:

1. MICRO SWITCH provides widest selection of oil-tight switches of this type.
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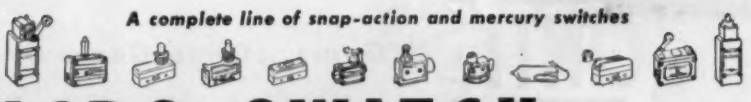
For almost two decades, manufacturers of high quality machinery, electronic devices and instruments have found MICRO SWITCH engineering assistance the quick, practical and economical answer to switching problems. "MICRO SWITCH, Freeport, Illinois" is the sterling mark of quality on precision switches. Call your nearest MICRO SWITCH branch for consultation and advice without obligation.

A complete line of snap-action and mercury switches



MICRO SWITCH provides a complete line of extremely reliable, small-size, high-capacity, snap-action precision switches and mercury switches. Available in a wide variety of sizes, shapes, weights, actuators and electrical characteristics. For all types of electrical controls.

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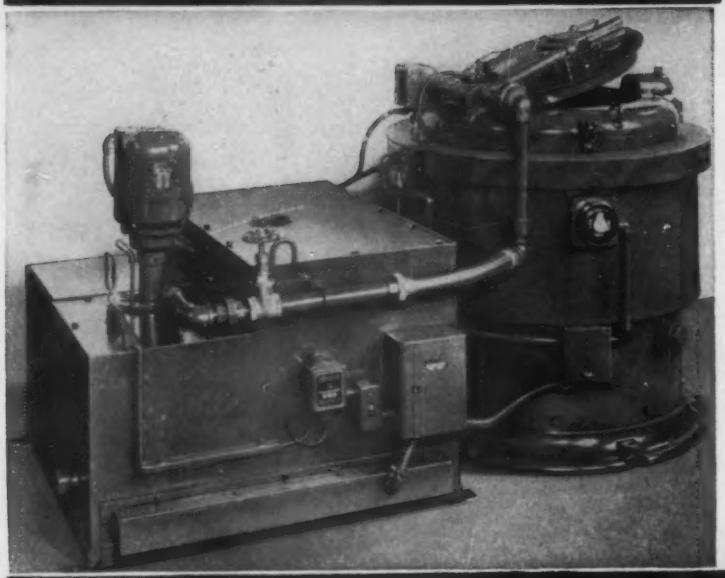
CONTROLLED IMPREGNATION by the BARRETT "HYDEWA" Centrifugal Process offers many advantages



The Hydewa Method assures fast production, by reducing the customary hours to minutes, high penetration, with controlled impregnation, also positive expulsion of air from the articles being impregnated.

The Centrifugal Process is limited in application only to the size of the articles that may be rotated in fair balance in the revolving bowl. Coils, condensers, transformers, braiding cotton insulated wire, paper tubes, pressboard spacers, rawhide and bristles, are but a few of the many typical products now being processed in Barrett Impregnators. Many products heretofore considered impractical for satisfactory impregnation by other methods have been successfully handled.

Basic units are self-contained, direct motor driven. Special arrangements and supplemental equipment also provided.

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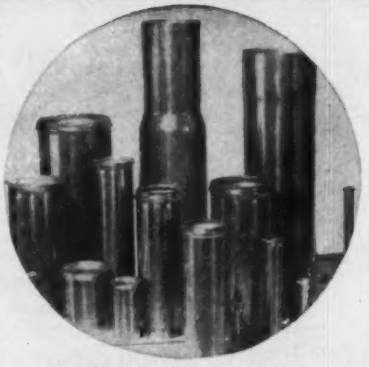

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Send for Bulletin G-3 showing typical tube-end forms and the various types of VAILL machines for handling the shaping and forming.

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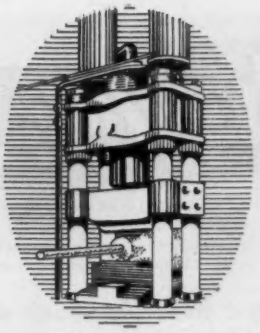
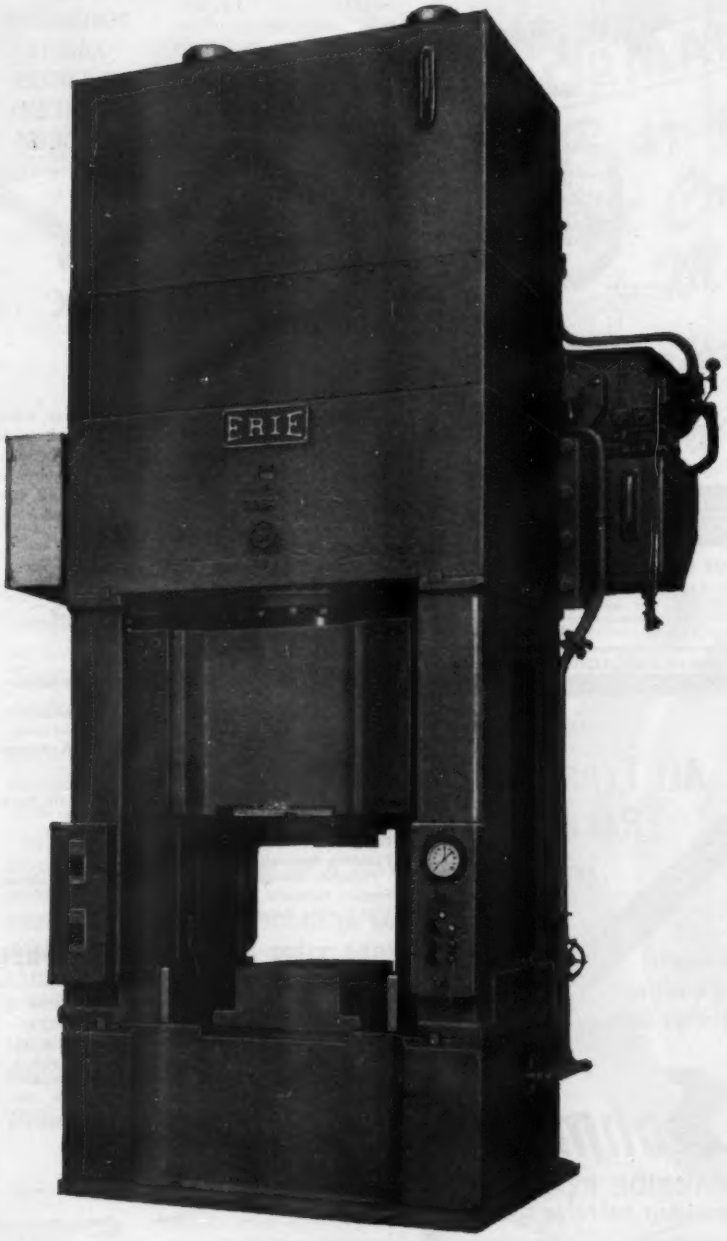


When press forging was done on steam hydraulic presses, water intensified . . . power strokes were short and slow.

Even then ERIE was the greatest name in forging machinery in both presses and hammers . . .



today

Erie Foundry has just built this extremely fast hydraulic forging press. This 1000-ton semi-automatic machine, used to forge jet engine turbine blades by a special process, completes a *6" stroke cycle in just 4 seconds.*

Its high speed is achieved by using two self-contained pumps. This forging press incorporates speed control with automatic pressure and precision reversal by means of a special compression and decompression feature, designed by Erie hydraulic engineers. Maximum stroke is 28". A long (1 to 1) guide ratio insures accuracy. By combining side housing and strain rod construction, the machine is made rigid and produces perfect forgings.

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in our 60th year

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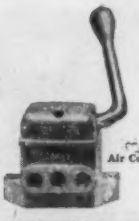
Logan air valves

A model to effectively meet practically any air control valve requirement. Designed to assure maximum efficiency with a minimum of maintenance.


Model 6550 Air Control Valve

82 models

most models stock delivery

Logan Air Control Valves are designed and built to assure an unusually high standard of performance plus maximum convenience for the design engineer, machine operator and maintenance man. Every construction detail has been planned to make Logan valves easy to install, to use and to service.

Thousands of manufacturers have found Logan valves to be the answer to their production problems. Logan engineers are at your service to help you achieve better, more efficient production. Following are a few facts about Logan Air Control Valves:

Standard valve models are available in a wide range of mounting types, means of actuation, type of handle and sizes.

Can be located in any position on horizontal, vertical or other surfaces. Mounting is simple.

Construction is compact—permits installation in limited space, close to other equipment.

All valves are built for operating pressures to 150 psi. For reuse, many Logan valves can easily be converted to other types. Parts are interchangeable.

The wide choice of types of control makes it possible to provide the most convenient type of actuation for every problem of regulation.

Effortless control is provided in all models. Balanced construction produces equal pressure on both sides of piston.

Valve piston is light in weight, permitting high-speed operation without excessive vibration or wear.

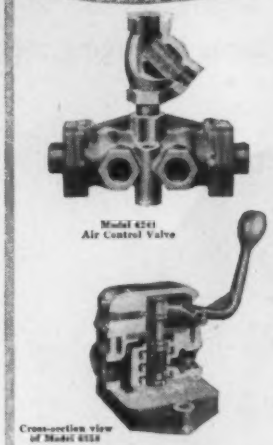
Long-life synthetic rubber cup packings on valve piston assure positive action without leakage.

Piston-type valve with sliding piston eliminates valve seats; minimizes wear.

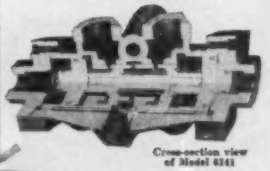
Self-cleaning construction means longer sealing life.

Valves are unusually easy to repair or recondition. Simply by removing cover screws—covers and valve piston can be quickly removed and replaced.

If a few spare pistons are carried in stock, a Logan air valve can be reconditioned with only a few minutes of downtime. Write for Logan Catalog 100-4.


Model 4241 Air Control Valve

Cross-section view of Model 6550


Cross-section view of Model 6241

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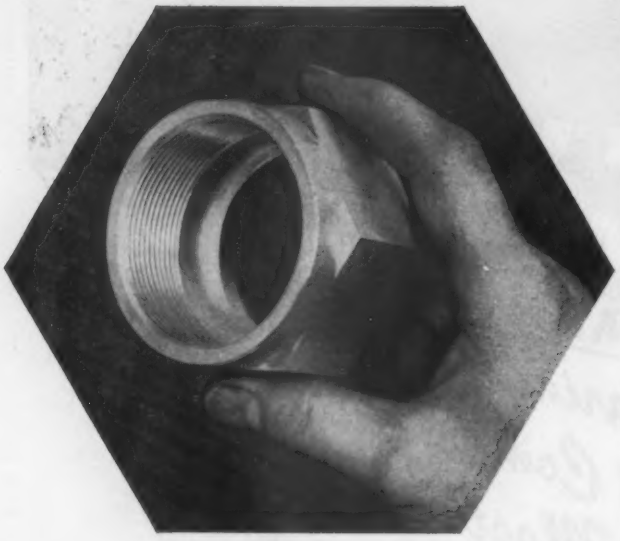

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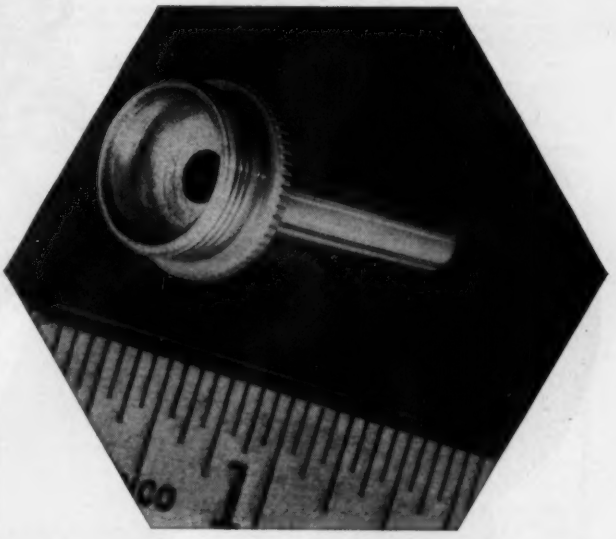

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- ☐ **Send staff to Red Cross courses. They may save your life.**
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FELLOWS No. 6I and 6IA High Speed Gear Shaper
FELLOWS No. 672 High Speed Gear Shaper; late
FELLOWS No. 7, 7A, No. 72 and No. 75 High Speed Gear Shaper; late type
FELLOWS No. 13 LS Lapper; motor drive, late
FELLOWS 20-M Red Liner; New 1954

GLEASON GEAR EQUIPMENT
GLEASON 3" Spiral Gear Generator; late type
GLEASON No. 7 Hyp. Cutter Sharp; latest type
GLEASON 12" Spiral Bev. Cutter Sharpener; M.D.
GLEASON 12" Straight Bevel Generator; late type
GLEASON No. 17 Hypoid Tester & Lapper; late
GLEASON No. 18 Gear Tester and Lapper; M.D.
GLEASON No. 20 Spur Gear Tester; latest type
GLEASON 25" Straight Bevel Gear Gen.; M.D.
GLEASON 24" and 37" Bevel Gear Planer; M.D.
GLEASON 25" Spiral Bevel Gear Gen.; M.D.
GLEASON No. 6 Rovacycle 5" cone distance; late

GRINDERS, Cyl. Plain & Univ.
CINCINNATI 14"x72" Universal; M.D., late type
CINCINNATI 6"x18" Mod ER Plain, "Filmatic"; late
LANDIS 20"x144" Plain Cyl. gap type, M.D., late
LANDIS 4"x12" Type H Hydraulic; late type
LANDIS 10"x18" type C Plain, Hydraulic, late
LANDIS 10"x36" type DC plain hydr. with infeed; late
LANDIS 16"x36" type "C" Universal, M.D. late
LANDIS 20"x144" Plain Gap Grinder; late type
NORTON 4"x12" Model CTU Plain, year 1953
NORTON 6"x18" Type "C" Plain; late type
NORTON 10"x48" Type C Hydr. Plain Cyl; late type

GRINDERS—Internal
BRYANT #5 Internal, hydraulic, late type
BRYANT #16-C-16 Internal, Hydraulic, late
BRYANT #24—36" Internal, hydraulic
HEALD #70A Internal, motor drive, late type
HEALD #78 Centerless; motor drive; late
HEALD #8I pl. chuck type, hydraulic; New 1947
BLANCHARD #18, motor drive; late type
BROWN & SHARPE #2, motor drive; late type

LATHES, Turret
GISHOLT #1L and #2L Saddle type; Timken; late
GISHOLT #3 Universal ram type; M.D., late type
LIBBY #4H, 12" hole, motor drive, late type
MOREY #2, #3, #4, #5, ram type; Timken; latest
WARNER & SWASEY #1-A Universal; Hex., late

LATHES, Engine & Mfg.
AMERICAN 16"x102" centers, "Pacemaker"; late type
AMERICAN 36"x25' c.c., PRT; 2 cross slides; late
GISHOLT #12 Hydraulic Automatic; motor drive; late
HENDEY 24"x36" centers; motor drive; late type
HENDEY 16"x72" centers; M.D., late type
LeBLOND 20"x48" centers, Timken; M.D., late type
LODGE & SHIPLEY 12"x30" centers, Toolroom
LODGE & SHIPLEY 14"x30" centers; late type
MONARCH 20" (raise to 30½") x 144" c.c., late type
MONARCH 24"x96" centers; motor drive; late type
NILES 30"x108" c.c. Geared Head; Timken; late
NILES 36"x100" centers "Time Saver"; motor drive
PRATT & WHITNEY 16"x30" centers; Timken, late
SPRINGFIELD 20"x40" c.c., motor drive; late type
SUNDSTRAND 10"x60" centers; auto Type B; late

MILLING MACHINES, Plain
BROWN & SHARPE #2B, motor drive, late type
BROWN & SHARPE #10, motor drive; late type

MILLING MACHINES, Thread
HALL Style "D" Planetary; late type
LEES BRADNER Model #LT 6"x36" and 6"x72"; #HT 12"x24" and #HT 12"x36" centers; late type
MOREY 12"x30" and 12"x160" centers; late type
CINCINNATI 2MH horizontal univ., motor drive, late
BROWN & SHARPE #2 Light Type, motor drive

MILLING MACHINES, Vertical
CINCINNATI #4 High Speed Dial type; late
CINCINNATI 0-8 Vertical; Timken; late type
MILWAUKEE #4-H Vertical; late type
STEINEL SV4d, #30 taper, 6 spindle speeds; latest

PLANERS
GRAY 48"x48"x10' "Maximum Service" 4 hds; PRT; DC; Reversing, Late type
LIBERTY 144"x76"x48" adj. openside; box table; 4 hds; vari-voltage; PRT; New 1949
NILES-BEMENT-POND 72"x72"x30'; 4 hds; PRT
POND 60"x60"x14', 4 heads, motor drive, late type
SOUTHWARK plate-edge Planer; 10 ft; late type

PRESSES
BLISS #410A, 825-ton double action toggle drawing
NATIONAL #5 "Maxi-Press", 1000-ton cap. H.E. Forging Machine; M.D.
WATERBURY FARREL #9, 125-ton cap., M.D.

SHAPERS
GOULD & EBERHARDT 32"; High Speed; M.D.
HENDEY 12" High Speed Univ. Crank Shaper; late
MOREY 8" Vertical; Motor drive; late type
ROCKFORD 16" Shaper, motor drive; late type

MISCELLANEOUS
ALEXANDER #2, 3-dim. Engraving NEW 1952
AVEY No. 2, 2-spindle Drill Press; late type
BARNES No. 172 Honing; M.D., hydr.; late type
HILLES & JONES #7 Plate Bending Roll; capacity 7/8" x 16'; motor drive
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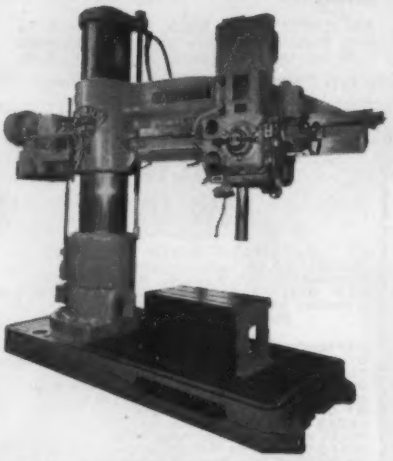

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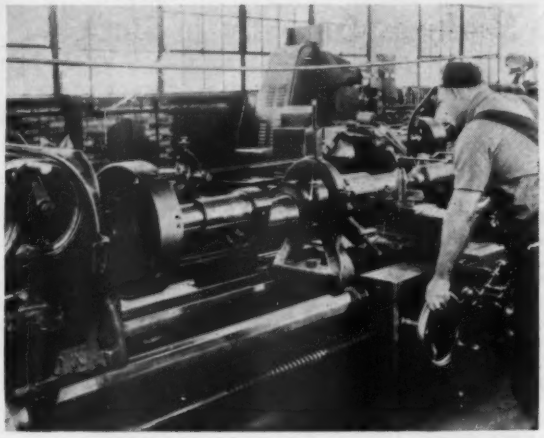

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No. 74 Heald Int. Centerless
No. 72-A Heald Univ. Int.
No. 72A8 Heald Int. (1943)
No. 72A5 Heald Bridge Int.
No. 74 Heald Ext. Bridge
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No. 5B Bryant Internal
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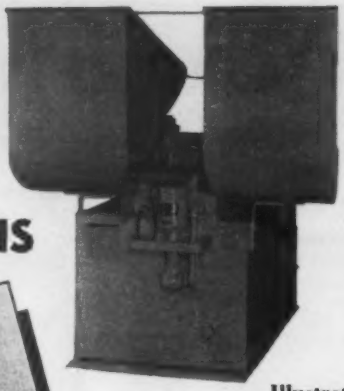

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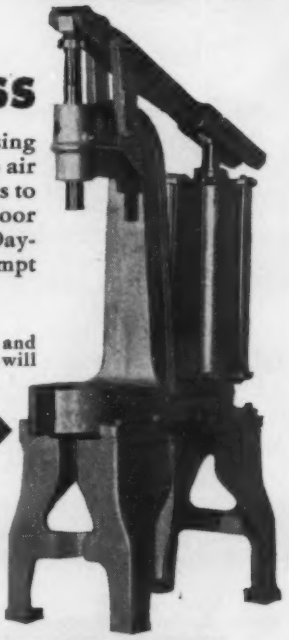

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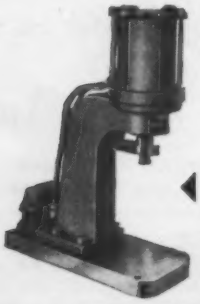

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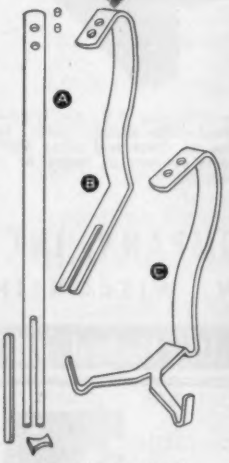

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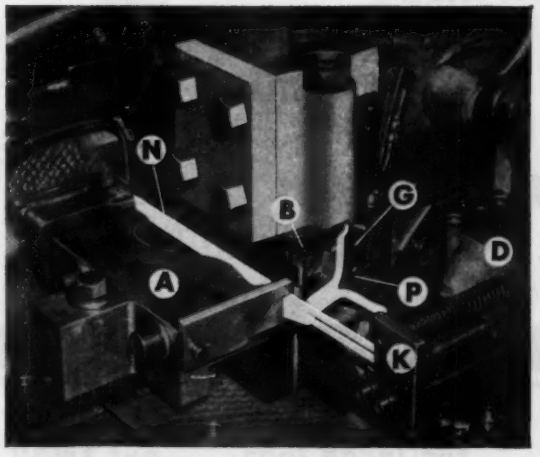

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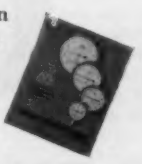

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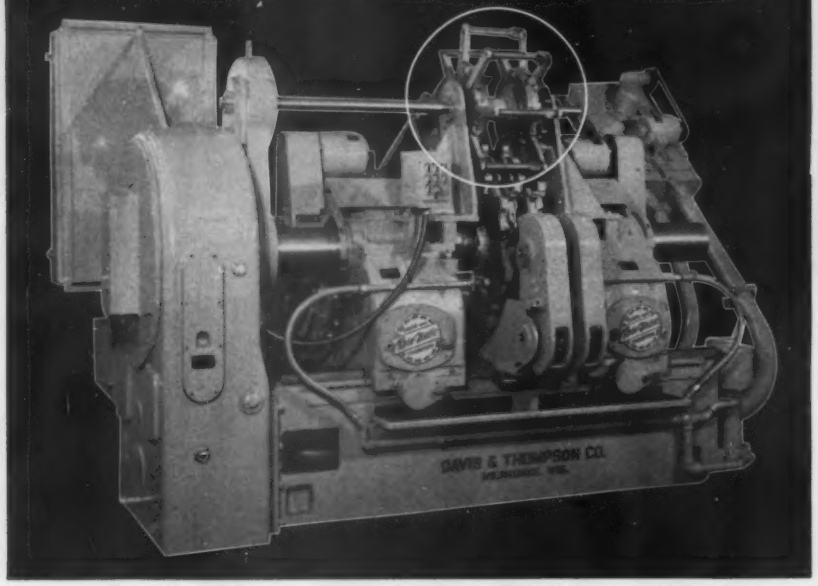

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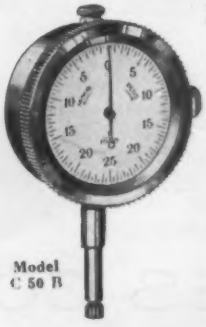

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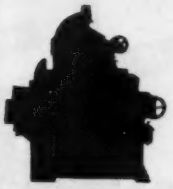

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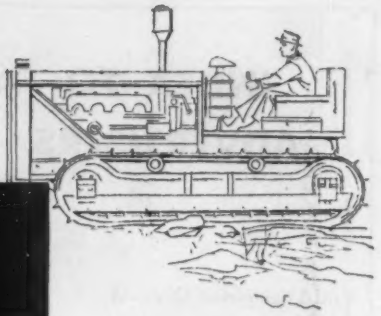

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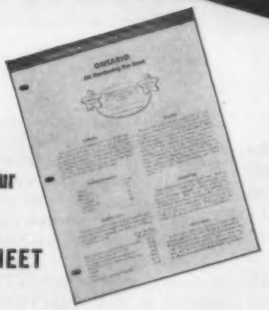

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(Sec. 34.9 P.L.&R.)
New York, N. Y.

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330 WEST 42nd ST.
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FYI — FOR YOUR INFORMATION

For your copy of any new catalog or bulletin, circle key number in the space indicated. Bulletins are described on pages 166 to 174.

To get more data about New Equipment, Materials and Parts, fully described on pages 144 to 154, just circle the appropriate key number.

To get more information about advertised products, circle the page number of the advertisement in which you are interested. If more than one advertisement is located on a single page, letters preceding number identify each advertisement. Key: T—Top; B—Bottom; R—Right, L—Left; TL—Top left, BL—Bottom left, TR—top right, BR Bottom right.

Requests for information made through *American Machinist* Readers' Service will be forwarded to the manufacturer as quickly as we can process them. If you write directly to the manufacturer, please identify advertisement by issue and page number to facilitate reply.

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26	27	28-9	30-1	32
32a-d	33	34-5	36-7	38-9
40	40a-b	41	42	43
44	45	46-7	48	49
50-1	52	53	54	55
56	57	58	59	60
61	62	63	64-5	66
67	68	69	70-1	72
74	76	78	80-1	82
85	86	88	127	128
130	132	134	149	150a-c
150d	151	153	155	156
157	158	159	160	161
162	163	164	165	T166
B166	167	168	169	170
171	172	173	174	175
176	177	TL178	BL178	R178
179	L182	TR182	TCR182	BCR182
BR182	183	184	185	186
187	L188	TR188	TCR188	BCR188
BR188	189	TL190	BL190	TR190
TCR190	BCR190	191	T192	BL192
BR192	193	TL194	BL194	BR194
195	L196	TR196	TCR196	BCR196
BR196	TL197	BL197	R197	TL204
BL204	R205	TL206	BL206	R207
TL208	BL208	R209	210	C3
C4				

BULLETINS

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NEW EQUIPMENT

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81				

CARD EXPIRES OCTOBER 15, 1955

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50-1 52 53 54 55
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BR182 183 184 185 186
187 L188 TR188 TCR188 BCR188
BR188 189 TL190 BL190 TR190
TCR190 BCR190 191 T192 BL192
BR192 193 TL194 BL194 BR194
195 L196 TR196 TCR196 BCR196
BR196 TL197 BL197 R197 TL204
BL204 R205 TL206 BL206 R207
TL208 BL208 R209 210 C3
C4

BULLETINS

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6 7 8 9 10
11 12 13 14 15
16 17 18 19 20
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NEW EQUIPMENT

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56 57 58 59 60
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76 77 78 79 80
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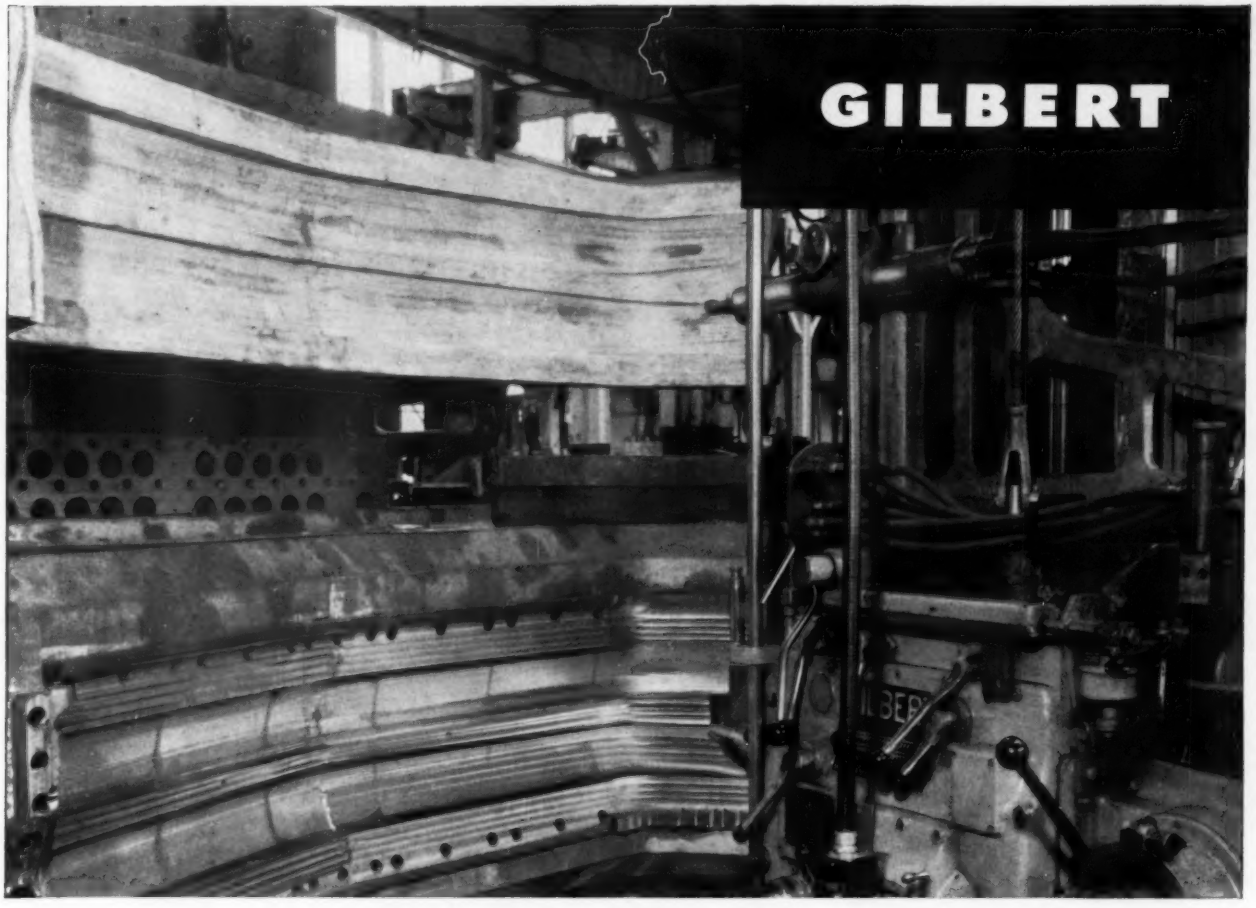
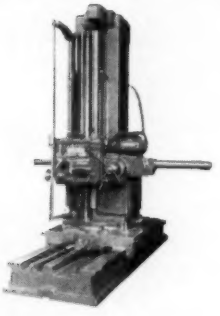


add reverse curves to your machining pitch



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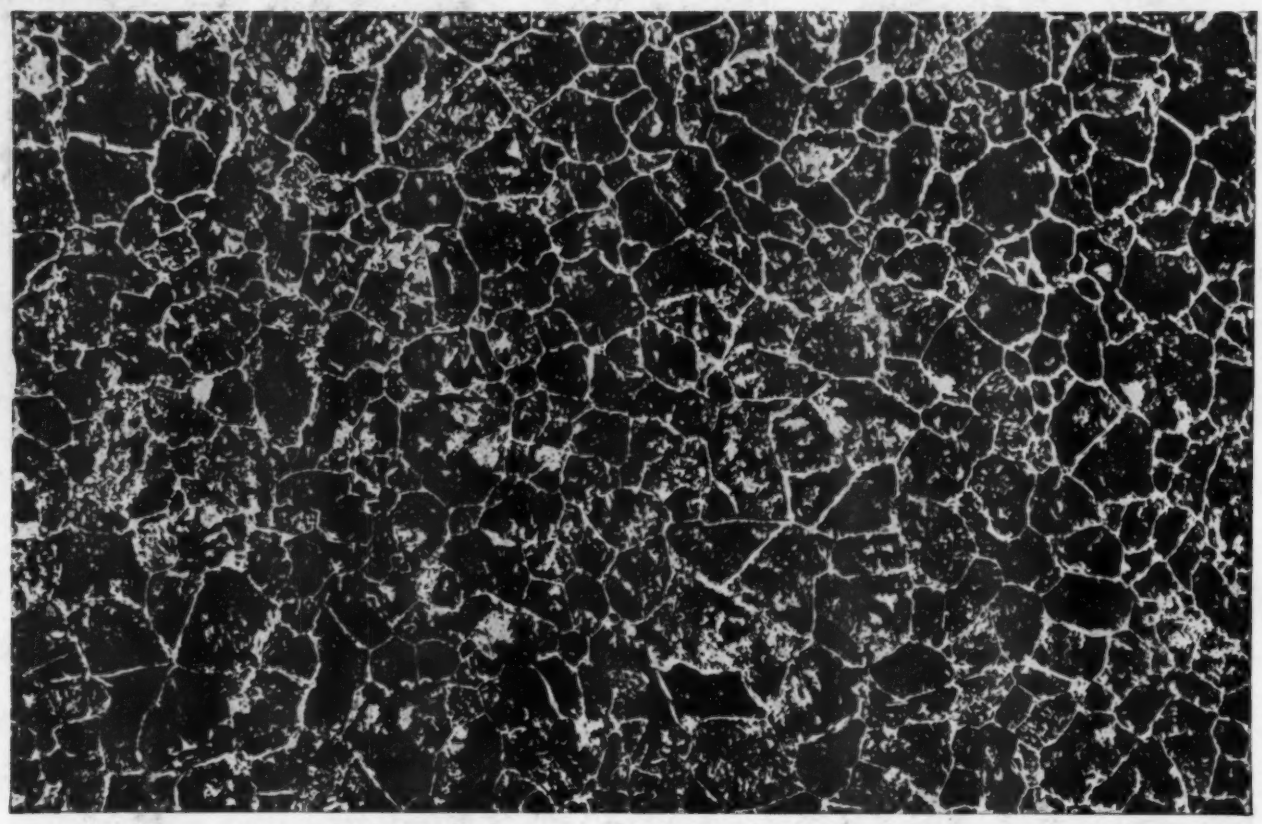
"It is also possible to machine cupped ends or reverse curves without having to move the job."

These are the words of Mr. Ed Miller, President of the Lansing Tool & Die Company, Lansing, Mich. With his two Cincinnati Gilbert Floor Type boring mills, he has offered customers machining services which couldn't be done on any other horizontal mills. Other equipment capable of doing these jobs costs several times more than the Gilberts.

For profiling and duplicating, a Gilbert offers you quick profits on a low investment. Bulletin 954 contains full descriptions and specifications. Write for it today. *The Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.*

those who buy Gilbert buy **GILBERT** *again*



See for yourself why TIMKEN® forging steels give you uniform, high quality forgings

NOTE the uniform grain size in this photomicrograph of Timken® forging steel. We examine every heat of Timken forging steel—spectrographically to assure uniform grain size. As a result, you can be sure that forgings made from Timken forging steels will give you uniformly high ductility and resistance to impact.

Because your order of Timken forging steel is handled individually in our mill we are able to target our conditioning procedure to your particular forging requirements. That minimizes your rejects.

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To top it off, Timken steel forging bars *save* you steel because their good dimensional tolerances produce uniform weight multiples with a minimum of steel lost in flashings. Get all these results in your forgings. Specify Timken forging steels. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

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